Nokia Customer Care

Service Manual

RM-135 (Nokia N76)
Mobile Terminal
Part No: 9203082 (Issue 1)

COMPANY CONFIDENTIAL

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	03/2007	MHa	

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IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- During testing never activate the GSM transmitter without a proper antenna load, otherwise GSM PA may be damaged.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Please send to:

NOKIA CORPORATION
Nokia Mobile Phones Business Group
Nokia Customer Care
PO Box 86
FIN-24101 SALO
Finland
E-mail: Service.Manuals@nokia.com

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Nokia N76 Service Manual Structure

1 General Information
2 Service Software Instructions
3 Service Tools and Service Concepts
4 BB Troubleshooting and Manual Tuning Guide
5 RF troubleshooting
6 Camera Module Troubleshooting
7 System Module and User Interface
Glossary

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1 — General Information

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Table of Contents

Product selection..1–5
Product features and sales package..1–6
Product and module list..1–8
Mobile enhancements..1–8
Technical specifications..1–10
  Transceiver general specifications..1–10
  Main RF characteristics for GSM850/900/1800/1900 and WCDMA2100 phones..1–10
  Battery endurance..1–11

List of Figures

Figure 1 RM-135 phone..1–5

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Product selection

RM-135 is a WCDMA/GSM dual mode handportable phone. It supports EGSM850/900/1800/1900 and WCDMA2100.

RM-135 is a 3GPP Release 4 terminal supporting CSD/HCSD, GPRS/EGPRS and WCDMA data bearers. For WCDMA the maximum bit rate is up to 384 kbps for downlink and 384 kbps for uplink with simultaneous CS speech or CS video (max. 64 kbps).

For 2G and 2.5G networks the RM-135 is a Class B EGPRS MSC 32, which means a in maximum download speed of up to 296kbit/s with EGPRS, and up to 107kbit/s with GPRS. According to GSM standard 05.05 it responds to class 4 (max. 2W) in GSM 850 and EGSM 900, class 1 (1W) is DCS 1800, and class 1 in PCS 1900.

RM-135 supports Bluetooth 2.0 + EDR standard and two-way video calls with two integrated cameras, on the front and one on the back. The main camera is an integrated 2 Megapixel camera with a digital zoom and the secondary CIF camera is for video calls.

RM-135 is an MMS (Multimedia Messaging Service) enabled multimedia device. The MMS implementation follows the OMA MMS standard release 1.2. It has a large 2.4’’ QVGA (320x240 pixels) TFT main display with 16 million colors, and a smaller 1,36” (128x160 pixels) TFT secondary display with 262k colors.

The HTML browser is a highly advanced internet browser also capable of viewing operator domain XHTML Mobile Profile (MP) content.

RM-135 uses Symbian 9.x (S60) operating system and supports also MIDP Java 2.0, providing a good platform for compelling 3rd party applications.

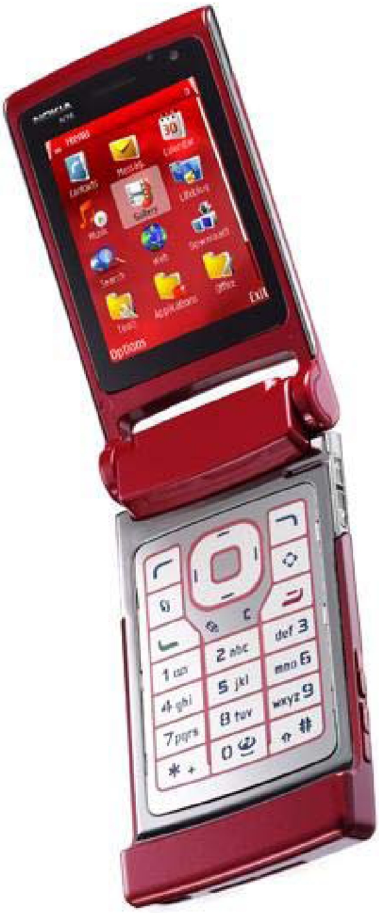

Figure 1 RM-135 phone

Product features and sales package

Imaging

Main camera:

- Sensor: CMOS, 2 megapixel
- F number/Aperture: F2.8
- Focal length: 4.4 mm
- Focus range: 40 cm to infinity
- Capture modes: still, video and sequenece

Video:

- Video resolutions: 320x240, 176x144 and 128x96
- Video clip length: 30 sec short mode or 1 hour free mode
- Video file format: .3GPP (*.3gp)
- White balance: automatic, sunny, cloudy, incandescent, fluorescent
- Colour tone: normal, sepia, B&W, vivid, negative
- Zoom (digital): 4x

Photo:

- Still image resolutions: 1600x1200, 1152x864 and 640x480
- Still image file format: EXIF (JPEG), *.jpg
- Exposure control: automatic
- White balance: automatic, sunny, cloudy, incandescent, fluorescent
- Colour tone: normal, sepia, B&W, vivid, negative
- Self-timer: 10, 20, 30 s
- Flash settings: Auto, off and forced
- Zoom (digital): 4x

Other camera features

- LED flash and red LED recording indicator
- Front camera, CIF (128x160 pixels) sensor

Music

- Digital music player: supports eAAC+/MP3//M4A/WMA with playlists
- Cover UI music keys
- OMA DRM 2.0 support for music
- Stereo FM radio (87.0-108 MHz)
- Integrated stereo handsfree speaker
- Stereo headset HS-43 with ECI control

Media

- Real-time video sharing
- Video streaming
- HTML browser over HTTP/TCP/IP stack

- Visual Radio™ support

Productivity

Messaging:

- OMA MMS 1.2, AMR and 3GGP SMIL Player
- Text to speech functionality (SMS reader)

Office applications:

- Push E-mail with support for attachments

Personal Information Management (PIM):

- Contacts, calendar, to-do, notes, calculator, clock

Synchronization:

- Local/Remote (using SyncML)
- Data: Calendar, Contacts, To-do, notes, E-mail
- PC Applications: Microsoft Outlook (2000, 2002, 2003), Outlook Express, Lotus Organizer (5.0, 6.0), Lotus Notes (5.0, 6.0)

Call management:

- Call logs, speed dial, enhanced voice dialling, voice commands
- Nokia Push to Talk (PoC)

Connectivity

- Mini USB interface with USB 2.0 Full speed
- 3.5mm AV connector
- Bluetooth wireless technology 2.0

Add-on software framework

- Symbian 9.x OS
- Nokia Series 60, 3rd edition, feature pack 3.1
- Java: MIDP2.0

Additional technical specifications

- Vibrating alert
- 3GPP Rel 4compliant
- Speech codecs supported in WCDMA: AMR
- Speech codecs supported in GSM: AMR, EFR, FR
- WCDMA HSDPA 2100 MHz with simultaneous voice and packet data (PS max speed DL/UL= 384kbps/ 384kbps, CS max speed 64kbps)
- Dual Transfer Mode (DTM) support for simultaneous voice and packet data connection in GSM/EDGE networks. Simple class A, multi slot class 11, max speed DL/UL: 236.8/177.6kbits/s
- EGPRS class B, multi slot class 32, (5 Rx + 3 Tx / max sum 6), max speed DL/UL= 296 / 177.6 kbits/s)
- GPRS class B, multi slot class 32 (5 Rx + 3 Tx / max sum 6), max speed DL/UL= 107 / 64.2 kbits/s)

Sales package

- Transceiver RM-135
- Charger (AC-5)

- Battery (BL-4B)
- Stereo headset with ECI (HS-43)
- Mini USB connectivity cable (DKE-2)
- CD ROM
- User Guide
- Quick Guide
- Sales carton

Product and module list

Module name	Type code	Notes
System/RF module	1SE	Main PWB with components.
Upper block module	1SH	
Camera PWB	1SG	
UI flex module	1SF	

Mobile enhancements

Data

Enhancement	Type
Connectivity cable	DKE-2
MicroSD card	MU-26 (128 MB)
	MU-27 (256 MB)
	MU-28 (512 MB)
	MU-22 (1 GB)
	MU-37 (2 GB)

Power

Enhancement	Type
Battery 700mAh	BL-4B
Compact charger	AC-3
Travel charger	AC-4
Charging adapter	CA-44

Audio

Enhancement	Type
Stereo headset	HS-43
	HS-48

Enhancement	Type
Music headset	HS-45
	AD-43
Headset	HS-41
Wireless headset	HS-4W
	HDW-3
	HS-26W
	HS-11W
	HS-36W
	HS-37W
Wireless clip-on headset	HS-21W
Bluetooth headset	BH-200
	BH-300
	BH-600
	BH-301
	BH-302
	BH-801
	BH-202
	BH-700
	BH-800
	BH-900
TTY adapter	HDA-12

Messaging

Enhancement	Type
Wireless keyboard	SU-8W
Digital pen	SU-1B
	SU-27W

Music

Enhancement	Type
Music headphones	HS-61
Advanced music headphones	HS-62
Mini speakers	MD-4
Music speakers	MD-3

Positioning

Enhancement	Type
Wireless GPS module	LD-3W
	LD-1W

Car

Enhancement	Type
Wireless plug-in car handsfree	HF-6W
	HF-35W
	HF-33W
Advanced car kit	CK-7W
Multimedia car kit	CK-20W
Car kit	Nokia 616
Universal holder	CR-39
Holder easy mount	HH-12
Mobile charger	DC-4
GPS module	LD-2

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm^3)
Transceiver with BL-4B 700mAh li-ion battery	106,5 x 52 x 13,7	115	70

Main RF characteristics for GSM850/900/1800/1900 and WCDMA2100 phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, or WCDMA2100
Rx frequency band	GSM850: 869 - 894MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA2100: 2110 - 2170 MHz

Parameter	Unit
Tx frequency band	GSM850: 824 - 849MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA2100: 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA -50 ... 24 dBm
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16

Battery endurance

Battery	Talk time	Stand-by	Video call time	Music playback time
BL-4B 700 mAh	up to 120 / 165 minutes (WCDMA / GSM)	up to 8.5 / 8.5 days (WCDMA / GSM)	up to 75 minutes	up to 8 hours (offline mode)

Charging times

AC-4
70 minutes

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2 — Service Software Instructions

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Table of Contents

Phoenix installation steps in brief....2–5
Installing Phoenix....2–6
Updating Phoenix installation....2–8
Uninstalling Phoenix....2–9
Repairing Phoenix installation....2–11
Phone data package overview....2–11
Installing phone data package....2–12
Uninstalling phone data package....2–15
Configuring users in Phoenix....2–17
Managing connections in Phoenix....2–17
Installing flash support files for FPS-10....2–20
Updating FPS-10 flash prommer software....2–23
Dead phone USB flashing....2–24

List of Figures

Figure 2 Dongle not found....2–6
Figure 3 Disclaimer text....2–7
Figure 4 InstallShield Wizard Complete....2–8
Figure 5 Installation interrupted....2–9
Figure 6 Remove program....2–10
Figure 7 Finish uninstallation....2–10
Figure 8 Repair program....2–11
Figure 9 Data package setup information....2–13
Figure 10 Data package destination folder....2–14
Figure 11 InstallShield Wizard Complete....2–15
Figure 12 Uninstalling phone data package....2–16
Figure 13 Finishing data package uninstallation....2–16
Figure 14 Phoenix login....2–17
Figure 15 New user configured....2–17
Figure 16 Select mode: Manual....2–18
Figure 17 Connections list....2–20
Figure 18 Connection information....2–20
Figure 19 Product support module information (example from RM-1)....2–20
Figure 20 Flash update welcome dialog....2–21
Figure 21 Flash installation interrupted....2–21
Figure 22 Flash destination folder....2–22
Figure 23 Finish flash update....2–23
Figure 24 Flash directory window....2–23
Figure 25 Prommer software update finished....2–24
Figure 26 Prommer Maintenance window....2–24

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Phoenix installation steps in brief

Prerequisites

Recommended hardware requirements:

- Computer processor: Pentium 700 MHz or higher
- RAM 256 MB
- Disk space 100-300 MB

Supported operating systems:

- *Windows 2000* Service Pack 3 or higher
- *Windows XP* Service Pack 1 or higher

Context

Phoenix is a service software for reprogramming, testing and tuning phones.

Phoenix installation contains:

- Service software support for all phone models included in the package
- Flash update package files for programming devices
- All needed drivers for:
  - PKD-1 (DK2) dongle
  - DKE-2 USB cable

> **Note:** Separate installation packages for flash update files and drivers are also available, but it is not necessary to use them unless there are updates between *Phoenix* service software releases. If separate update packages are used, they should be used after *Phoenix* and data packages have been installed.

The phone model specific data package includes all changing product specific data:

- Product software binary files
- Files for type label printing
- Validation file for the faultlog repair data reporting system
- All product specific configuration files for *Phoenix* software components

> **Note:** *Phoenix* and phone data packages should only be used as complete installation packages. Uninstallation should be made from the *Windows* Control Panel.

To use *Phoenix*, you need to:

Steps

1. Connect a compatible SW dongle (refer to service tools list and setups) to the computer parallel or USB port.
2. Install *Phoenix*.
3. Install the phone-specific data package.
4. Configure users.

5. Manage connection settings (depends on the tools you are using).

If you use FPS-10:	• Update FPS-10 software **Note:** There is no need to activate FPS-10. • Activate SX-4 smart card, if you need tuning and testing functions. **Note:** When FPS-10 is used only for product software updates, SX-4 smart card is not needed.

Results

Phoenix is ready to be used with FPS-10 flash prommer and other service tools.

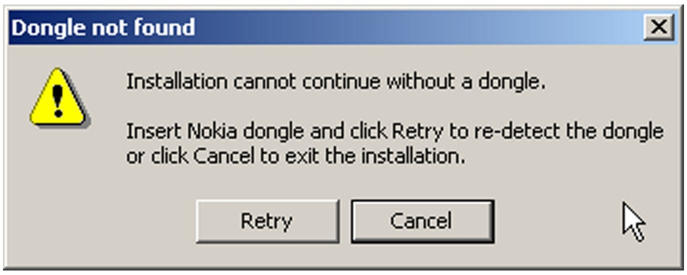
Installing *Phoenix*

Prerequisites

- Check that a dongle is attached to the parallel or USB port of your computer.
- Download the *Phoenix* installation package (for example, *phoenix_service_sw_2004_39_x_xx.exe*) to your computer (in *C:|TEMP*, for instance).
- Close all other programs.
- Depending on your operating system, administrator rights may be required to install *Phoenix*.
- If uninstalling or rebooting is needed at any point, you will be prompted by the InstallShield program.

Context

At some point during the installation procedure, you may get the following message:



Installation cannot continue without a dongle.

Insert Nokia dongle and click Retry to re-detect the dongle or click Cancel to exit the installation.

Figure 2 Dongle not found

This may be a result of a defective or too old PKD-1 dongle.

Check the COM/parallel ports or USB ports used. After correcting the problem, you can restart the installation.

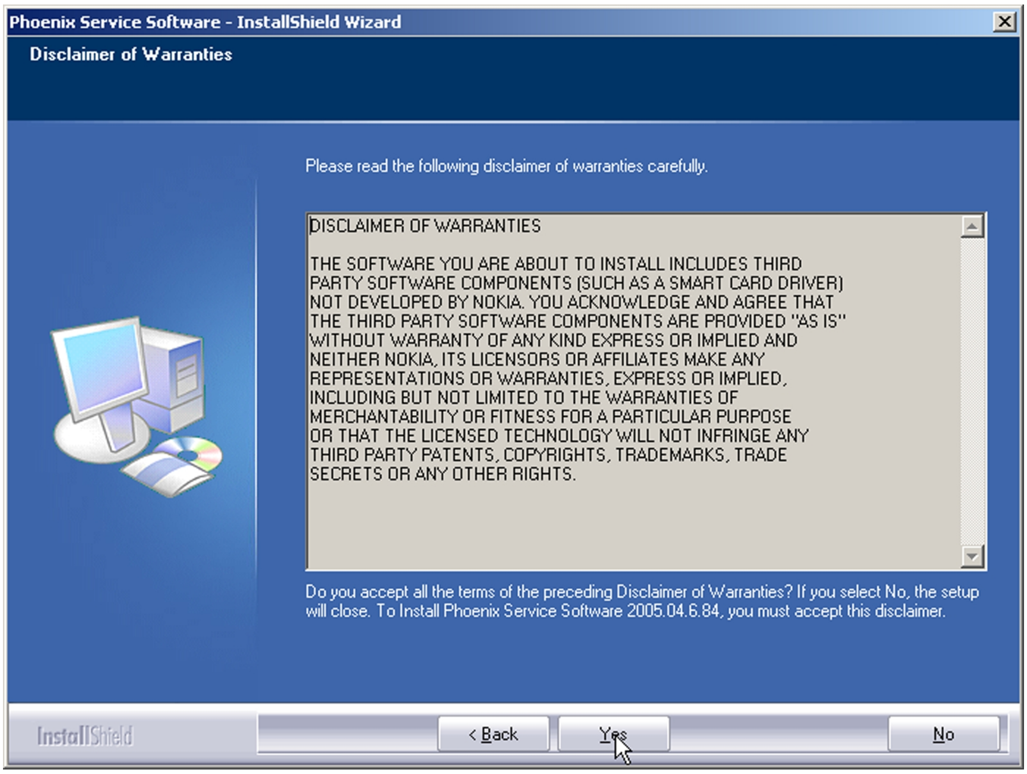
For more detailed information, please refer to *Phoenix* Help files.

> **Tip:** Each feature in *Phoenix* has its own Help function, which can be activated while running the program. Press the **F1** key or the feature's **Help** button to activate a Help file.

Steps

1. To start the installation, run the application file (for example,*phoenix_service_sw_2004_39_x_xx.exe*).
2. In the *Welcome* dialogue, click **Next**.

3. Read the disclaimer text carefully and click **Yes**.



Phoenix Service Software - InstallShield Wizard

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Do you accept all the terms of the preceding Disclaimer of Warranties? If you select No, the setup will close. To Install Phoenix Service Software 2005.04.6.84, you must accept this disclaimer.

Figure 3 Disclaimer text

4. Choose the destination folder.

   The default folder *C:|ProgramFiles|Nokia|Phoenix* is recommended.

5. To continue, click **Next.**

   To choose another location, click **Browse** (not recommended).

6. Wait for the components to be copied.

   The progress of the installation is shown in the *Setup Status* window.

7. Wait for the drivers to be installed and updated.

   The process may take several minutes to complete.

   If the operating system does not require rebooting, the PC components are registered right away.

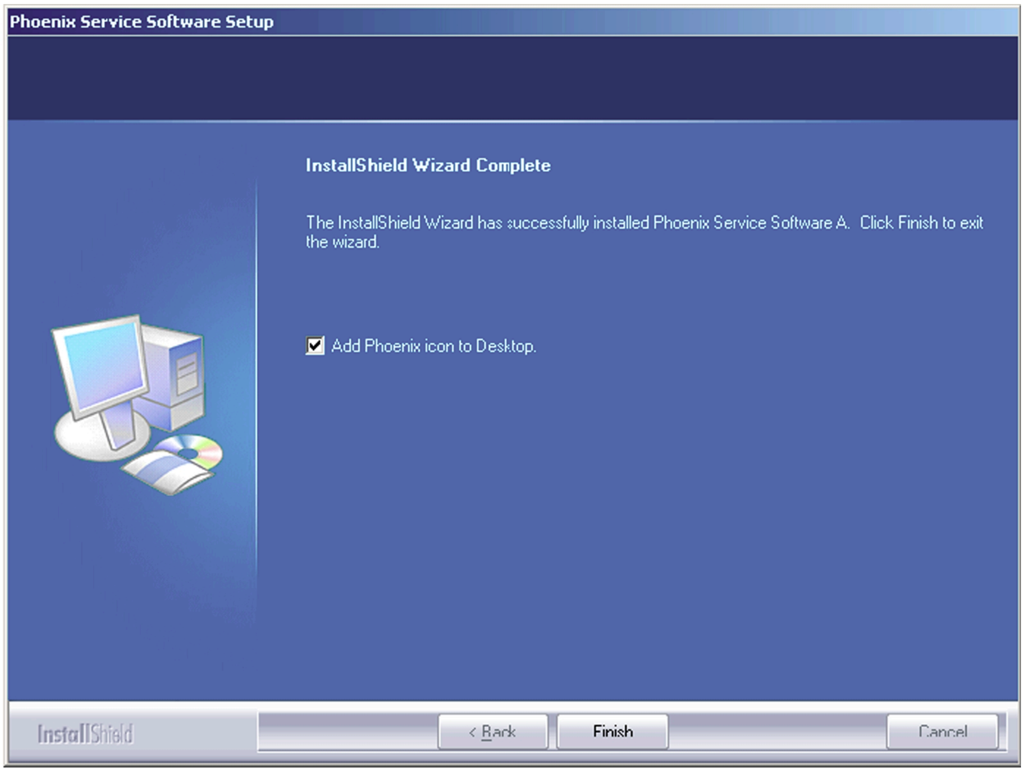
   If the operating system requires restarting your computer, the Install Shield Wizard will notifies about it.

   Select **Yes...** to reboot the PC immediately or **No...** to reboot the PC manually afterwards.

   After the reboot, all components are registered.

   Note: *Phoenix* does not work, if the components have not been registered.

8. To end the installation, click **Finish**.



InstallShield Wizard Complete

The InstallShield Wizard has successfully installed Phoenix Service Software A. Click Finish to exit the wizard.

☑ Add Phoenix icon to Desktop.

Figure 4 InstallShield Wizard Complete

Next actions

After the installation, *Phoenix* can be used after:

- installing phone model specific data package for *Phoenix*
- configuring users and connections

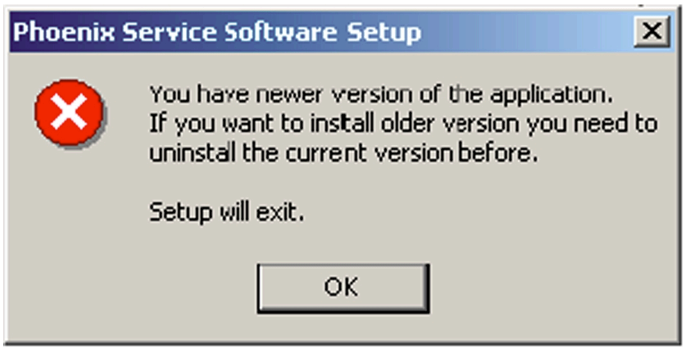
FPS-10 flash prommer can be used after updating their flash update package files. FLS-5 flash prommer can also be used.

Updating *Phoenix* installation

Context

- If you already have the *Phoenix* service software installed on your computer, you need to update the software when new versions are released.
- To update *Phoenix*, you need to follow the same steps as when installing it for the first time.
- When you are updating, for example, from version **a14_2004_16_4_47** to **a15_2004_24_7_55**, the update will take place automatically without uninstallation.
- Always use the latest available versions of both *Phoenix* and the phone-specific data package. Instructions can be found in the phone model specific Technical Bulletins and phone data package *readme.txt* files (shown during installation).
- If you try to update *Phoenix* with the same version you already have (for example, **a15_2004_24_7_55** to **a15_2004_24_7_55**), you are asked if you want to uninstall the existing version. In this case you can choose between a total uninstallation or a repair installation in a similar way when choosing to uninstall the application from the *Windows* Control Panel.

- If you try to install an older version (for example, downgrade from **a15_2004_24_7_55** to **a14_2004_16_4_47**), installation will be interrupted.



You have newer version of the application.
If you want to install older version you need to uninstall the current version before.

Setup will exit.

Figure 5 Installation interrupted

- Always follow the instructions on the screen.

Steps

1. Download the installation package to your computer hard disk.
2. Close all other programs.
3. Run the application file (for example, *phoenix_service_sw_2004_39_x_xx.exe*).

Results

A new *Phoenix* version is installed and driver versions are checked and updated.

Uninstalling *Phoenix*

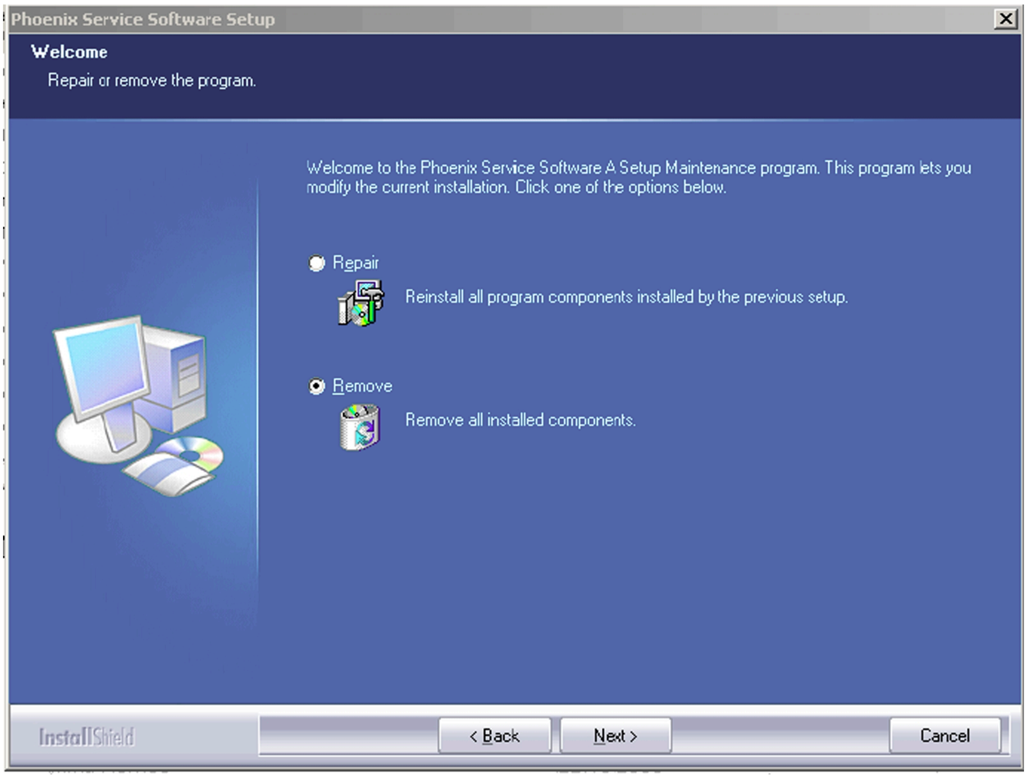
Context

You can uninstall *Phoenix* service software manually from the *Windows* Control Panel.

Steps

1. Open the **Windows Control Panel**, and choose **Add/Remove Programs**.

2. To uninstall *Phoenix*, choose **Phoenix Service Software→Change/Remove→Remove** .



Phoenix Service Software Setup
Welcome
Repair or remove the program.
Repair
Remove
InstallShield
< Back
Next >
Cancel

Welcome to the Phoenix Service Software A Setup Maintenance program. This program lets you modify the current installation. Click one of the options below.

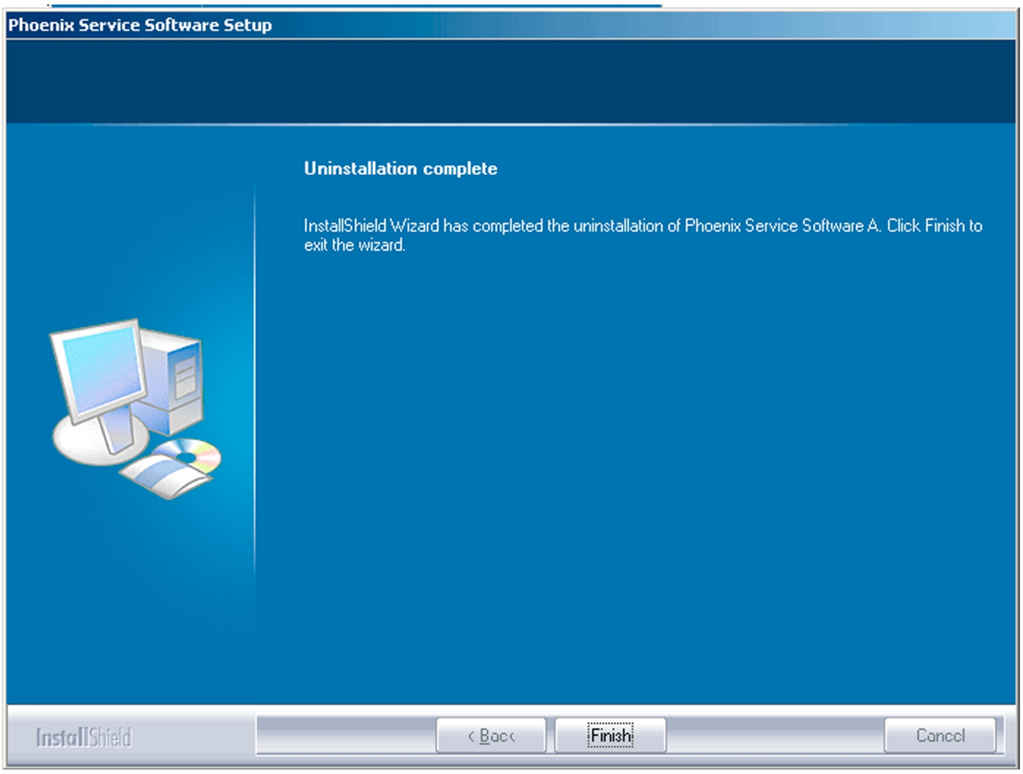
○ Repair
Reinstall all program components installed by the previous setup.

● Remove
Remove all installed components.

Figure 6 Remove program

The progress of the uninstallation is shown.

3. If the operating system does not require rebooting, click **Finish** to complete.



Phoenix Service Software Setup
InstallShield
< Back
Finish
Cancel

Uninstallation complete

InstallShield Wizard has completed the uninstallation of Phoenix Service Software A. Click Finish to exit the wizard.

Figure 7 Finish uninstallation

If the operating system requires rebooting, InstallShield Wizard will notify you. Select **Yes...** to reboot the PC immediately and **No...** to reboot the PC manually afterwards.

Repairing *Phoenix* installation

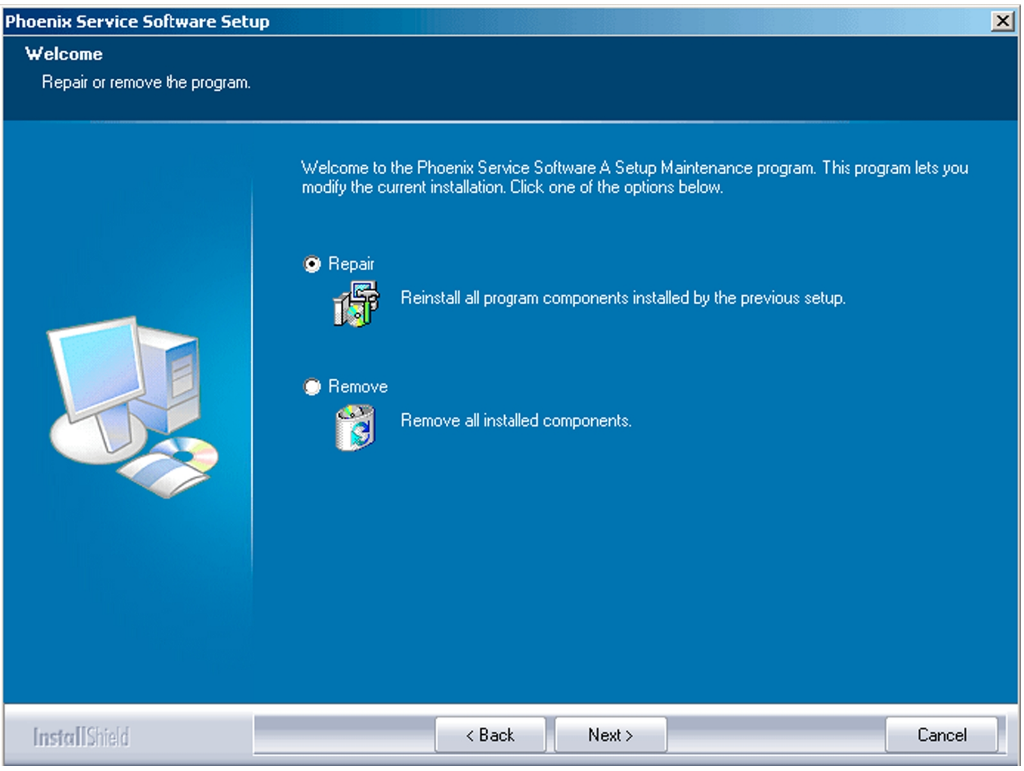
Context

If you experience any problems with the service software or suspect that files have been lost, use the repair function before completely reinstalling *Phoenix*.

> **Note:** The original installation package (for example, *phoenix_service_sw_a15_2004_24_7_55.exe*) must be found on your PC when you run the repair setup.

Steps

1. Open **Windows Control Panel→Add/Remove Programs** .
2. Choose **Phoenix Service Software→Change/Remove** .
3. In the following view, select **Repair**.



Phoenix Service Software Setup

Welcome

Repair or remove the program.

Welcome to the Phoenix Service Software A Setup Maintenance program. This program lets you modify the current installation. Click one of the options below.

● Repair

Reinstall all program components installed by the previous setup.

○ Remove

Remove all installed components.

Figure 8 Repair program

Phoenix reinstalls components and registers them.

The procedure is the same as when updating *Phoenix*.

4. To complete the repair, click **Finish**.

Phone data package overview

Each product has its own data package (DP). The product data package contains all product-specific data files to make the Phoenix service software and tools usable with a certain phone model.

The phone data package contains the following:

- Product software binary files

- Files for type label printing
- Validation file for the fault log repair data reporting system
- All product-specific configuration files for Phoenix software components

Data files are stored in **C:\Program Files\Nokia\Phoenix** (default).

Installing phone data package

Prerequisites

- A phone-specific data package contains all data required for the *Phoenix* service software and service tools to be used with a certain phone model.
- Check that a dongle is attached to the parallel port of your computer.
- Install *Phoenix* service software.
- Download the installation package (for example, *XX-XX_dp_EA_v_1_0.exe*) to your computer (for example, in C:\TEMP).
- Close all other programs.

(XX-XX = type designator of the product)

If you already have *Phoenix* installed on your computer, you will need to update it when a new version is released.

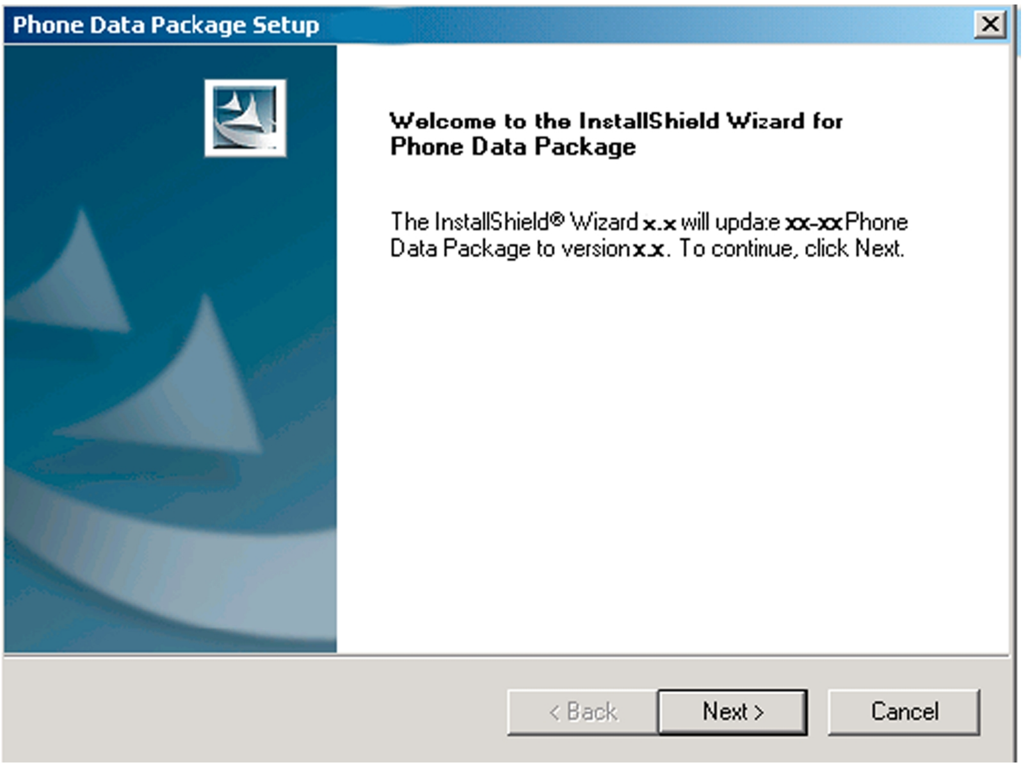
> **Note:** Often *Phoenix* and the phone-specific data package come in pairs, meaning that a certain version of *Phoenix* can only be used with a certain version of a data package. Always use the latest available versions of both. Instructions can be found in phone-specific Technical Bulletins and *readme.txt* files of data packages.

Steps

1. To start the installation, run the application file (for example, *XX-XX_dp_EA_ v_1_0.exe*),

   Wait for the installation files to be extracted.

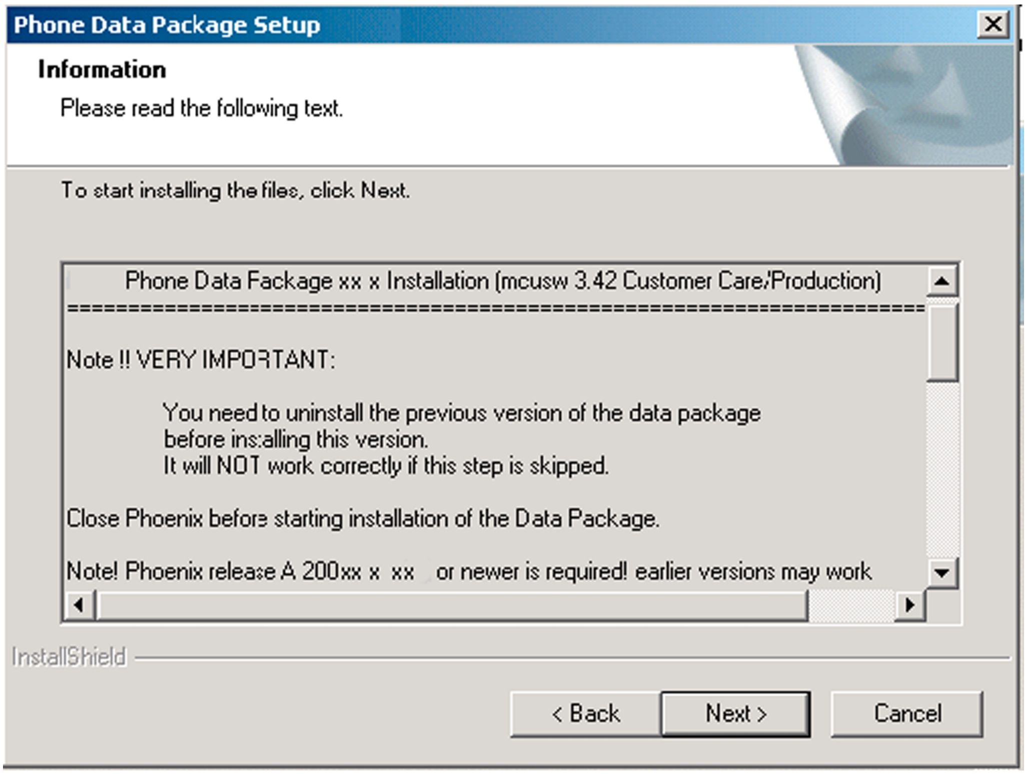
2. Click **Next**.



Welcome to the InstallShield Wizard for Phone Data Package

The InstallShield® Wizard **x.x** will update **xx-xx** Phone Data Package to version **x.x**. To continue, click Next.

3. In the following view you can see the contents of the data package. Read the text carefully. There is information about the *Phoenix* version required with this data package.



Information

Please read the following text.

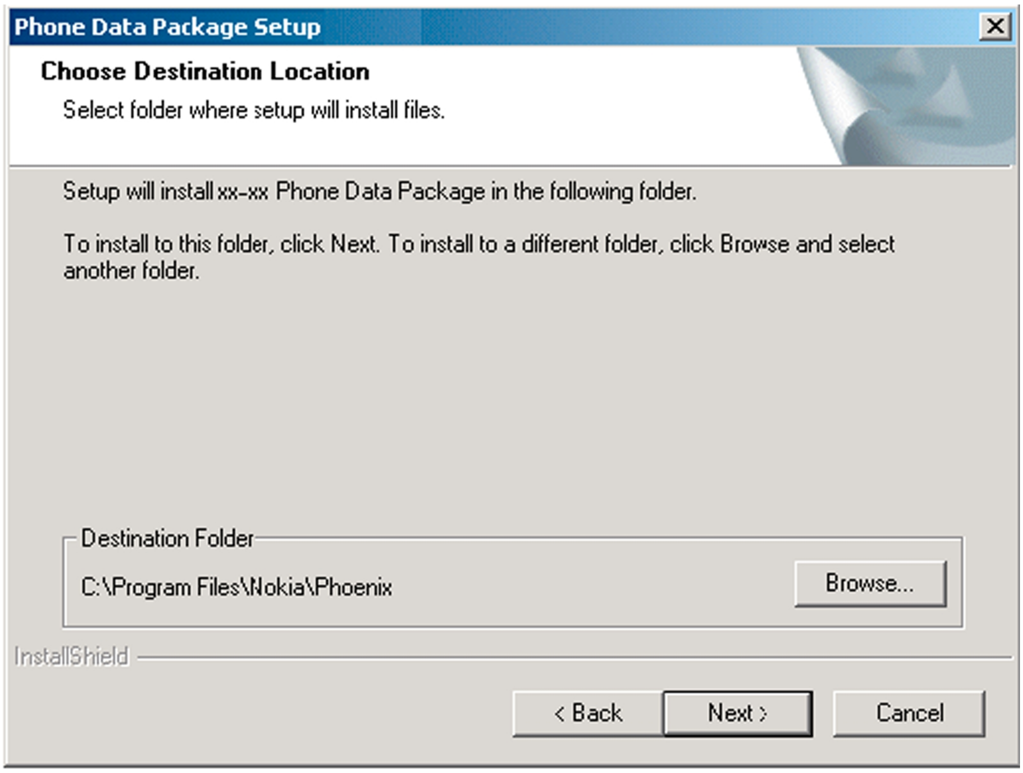
To start installing the files, click Next.

```
     Phone Data Package xx x Installation (mcusw 3.42 Customer Care/Production)
===========================================================================

Note !! VERY IMPORTANT:

          You need to uninstall the previous version of the data package
          before installing this version.
          It will NOT work correctly if this step is skipped.

Close Phoenix before starting installation of the Data Package.

Note! Phoenix release A 200xx x  xx   or newer is required! earlier versions may work
```

Figure 9 Data package setup information

4. To continue, click **Next**.

5. Choose the destination folder, and click **Next** to continue.



Phone Data Package Setup

Choose Destination Location

Select folder where setup will install files.

Setup will install xx-xx Phone Data Package in the following folder.

To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

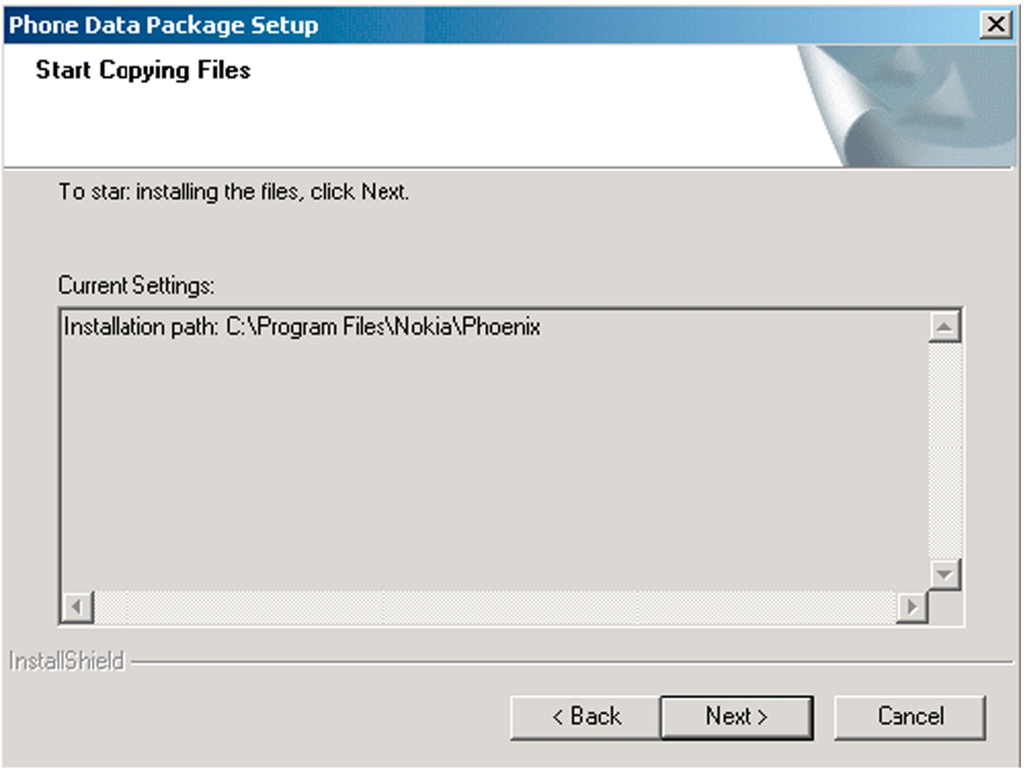
Destination Folder

C:\Program Files\Nokia\Phoenix

Figure 10 Data package destination folder

The InstallShield Wizard checks where *Phoenix* is installed, and the directory is shown.

6. To start copying the files, click **Next**.



Phone Data Package Setup

Start Copying Files

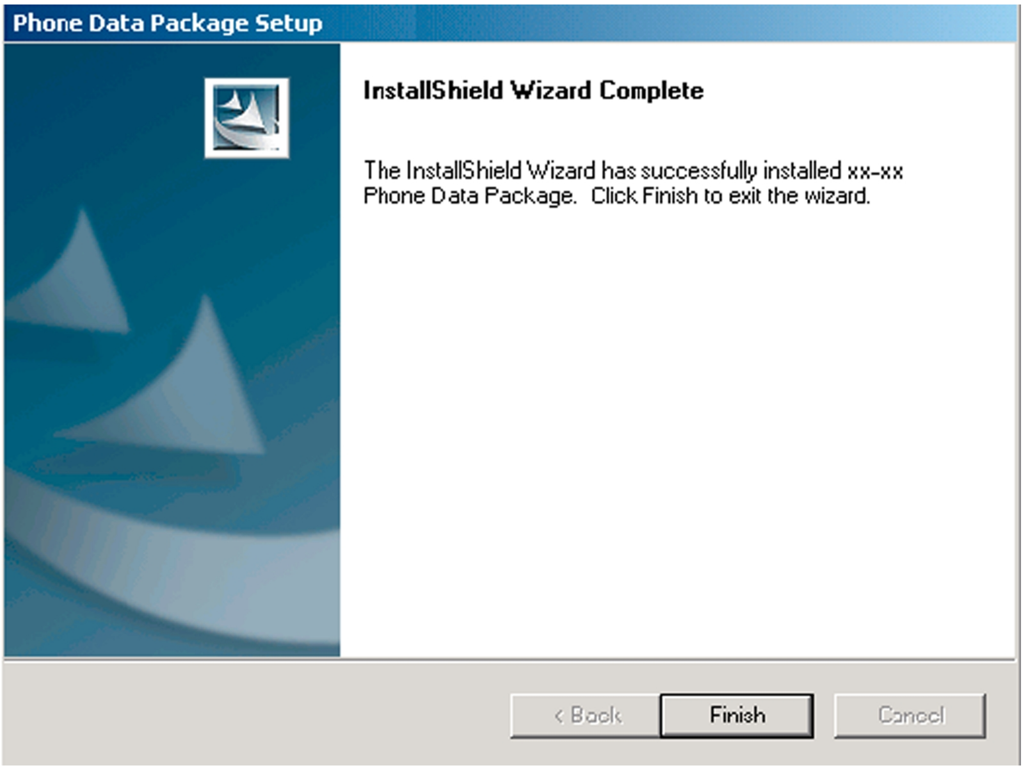
To start installing the files, click Next.

Current Settings:

Installation path: C:\Program Files\Nokia\Phoenix

Phone model specific files are installed. Please wait.

7. To complete the installation, click **Finish**.



InstallShield Wizard Complete

The InstallShield Wizard has successfully installed xx-xx Phone Data Package. Click Finish to exit the wizard.

Figure 11 InstallShield Wizard Complete

Next actions

Phoenix can be used for flashing phones and printing type labels after:

- Configuring users
- Managing connections

FPS-10 can be used after updating its flash update package files. FLS-5 flash prommer can also be used.

Uninstalling phone data package

Context

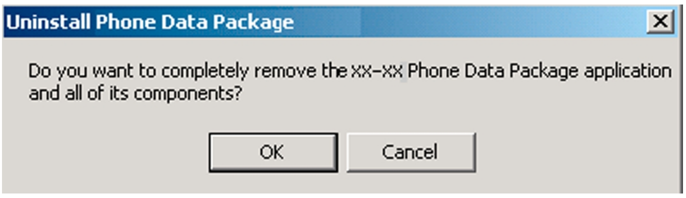
There is no need to uninstall an older version of a data package, unless instructions to do so are given in the *readme.txt* file of the data package and bulletins related to the release.

Please read all related documents carefully.

Steps

1. Locate the data package installation file (e.g. *XX-XX_dp_EA_v_1_0.exe*) from your computer.
2. To start the uninstallation procedure, double-click the data package installation file.

3. To uninstall the data package, click **OK** or to interrupt the uninstallation, click **Cancel**.

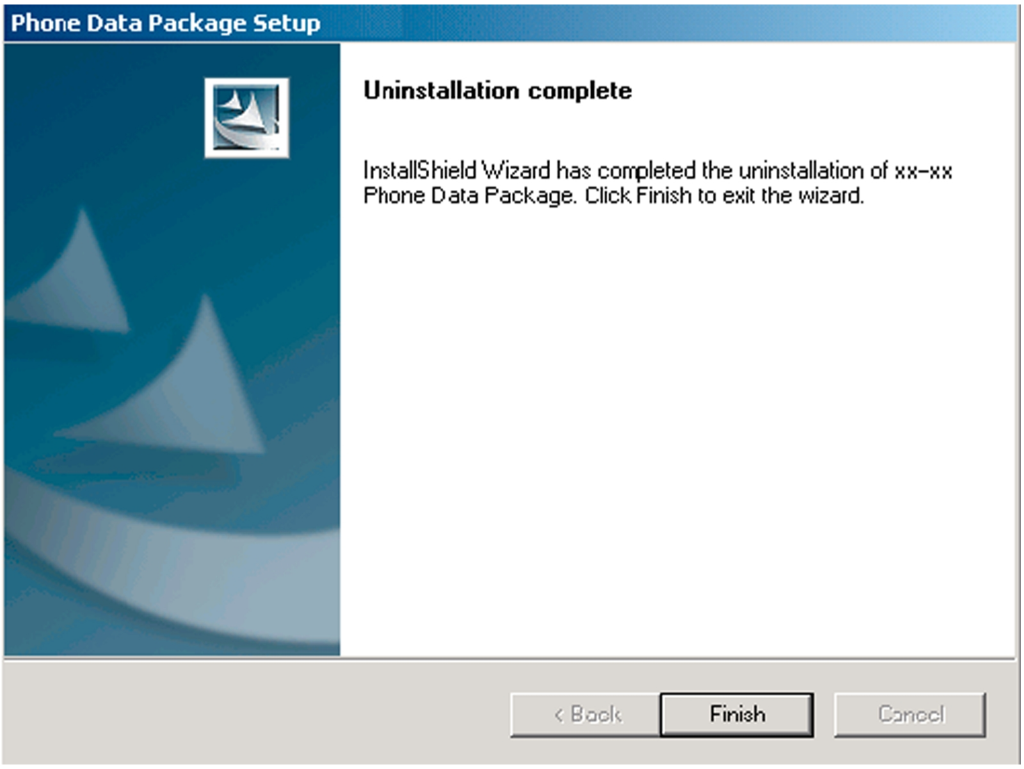


Uninstall Phone Data Package
OK
Cancel

Do you want to completely remove the xx-xx Phone Data Package application and all of its components?

Figure 12 Uninstalling phone data package

4. When the data package is uninstalled, click **Finish**.



Phone Data Package Setup
< Back
Finish
Cancel

Uninstallation complete

InstallShield Wizard has completed the uninstallation of xx-xx Phone Data Package. Click Finish to exit the wizard.

Figure 13 Finishing data package uninstallation

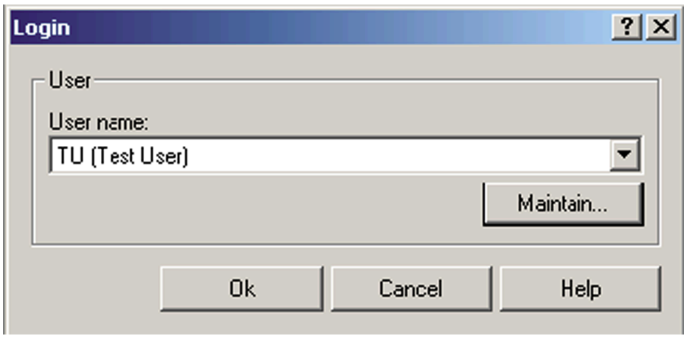
Alternative steps

- You can also uninstall the data package manually from **Control Panel→Add/Remove Programs→xx-xx* Phone Data Package** . (*= type designator of the phone).

Configuring users in *Phoenix*

Steps

1. Start *Phoenix* service software, and log in.



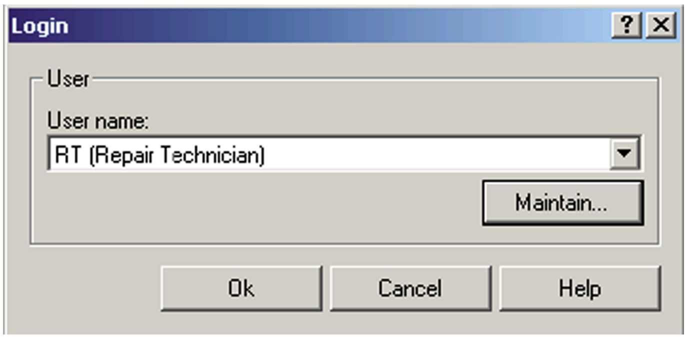
User name: TU (Test User)

Figure 14 Phoenix login

If the user ID is already configured, select s/he from the *User name* drop-down list, and click **OK**.

2. To add a new user, or to edit existing ones, click **Maintain**.
3. To add a new user, click **New**.
4. Type in the name and initials of the user, and click **OK**.

   The user is added to the user name list.
5. Select the desired user from the *User name* drop-down list, and click **OK**.



User name: RT (Repair Technician)

Figure 15 New user configured

Managing connections in *Phoenix*

Context

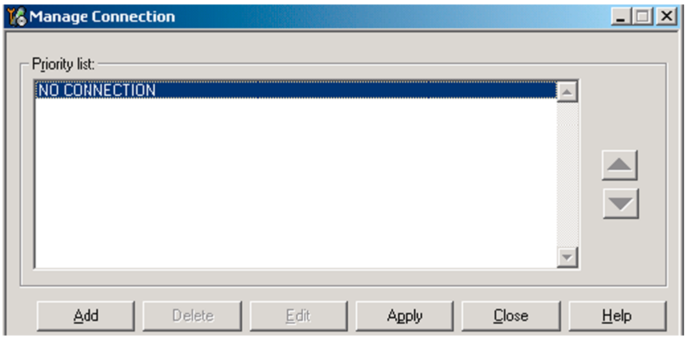
With the **Manage Connections** feature you can edit and delete existing connections or create new ones.

> **Note:** After choosing the desired connection, and connecting the phone to a PC for the first time, allow the PC to install the USB device drivers first. Please note that this may take some time to complete.
>
> If there are problems after the driver installation, check that the USB connection is active from the **Windows Control Panel**. If the problem persists, contact the local PC support.

Steps

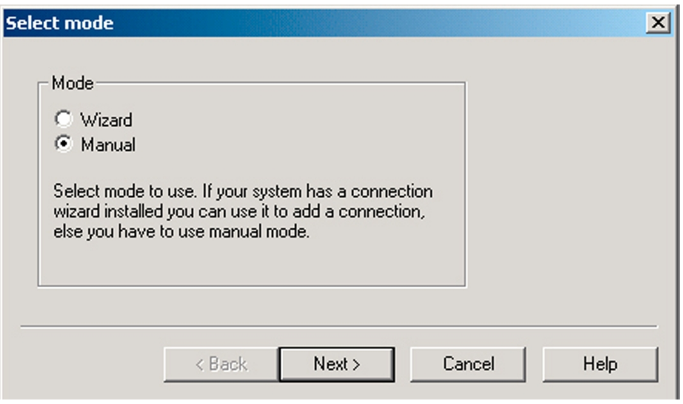
1. Start *Phoenix*, and log in.
2. Choose **File→Manage Connections...** .

3. To add a new connection, click **Add**.



4. Select **Manual** mode, and click **Next** to continue.

   If you want to create the connection using the Connection Wizard, connect the tools and a phone to your PC. The wizard will automatically try to configure the correct connection.



Select mode to use. If your system has a connection wizard installed you can use it to add a connection, else you have to use manual mode.

Figure 16 Select mode: Manual

i For an FPS-10 flash prommer with a **USB Connection**, choose the following connection settings:

- Media: **FPS-10 USB**
- DEVICE_INDEX: **0**
- SERIAL_NUM: See Serial No from the label attached to the bottom of FPS-10
- ACTIVE_MEDIA: **USB**

ii For an FPS-10 flash prommer with a **LAN connection**, choose the following connection settings:

- Media: **FPS-10 TCP/IP**
- NET_SERV_NAME: Click **Scan...**. Choose your own FPS-10 device based on the correct MAC address. See Serial No from the label attached to the bottom of your FPS-10.
- PORT_NUM: Use the default value, and click **Next**.
- PROTOCOL_FAMILY: Use the default value, and click **Next**.
- SOCKET TYPE: Use the default value, and click **Next**.
- TX_BUFFER_SIZE: Use the default value, and click **Next**.
- RX_BUFFER_SIZE: Use the default value, and click **Next**.

iii For a plain **USB connection**, choose the following connection settings:

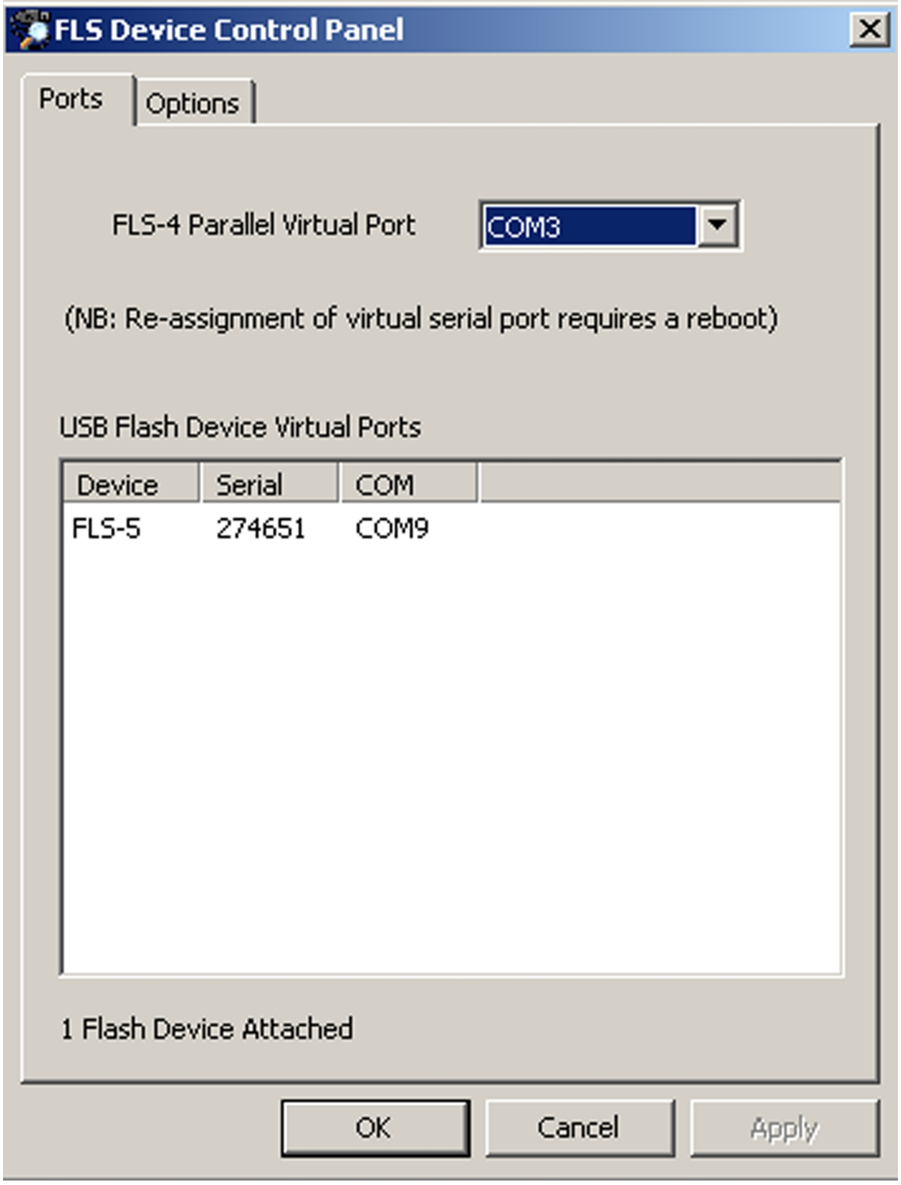
Note: First connect the DKE-2 cable between the PC USB port and phone.

- Media: USB

iv For an FSL-5 flash prommer choose the following connection settings:

- Media: FBus
- PORT_NUM: xx

  See the correct Port from the FLS Device Control Panel at the right hand side bottom corner in the system tray. Click at the symbol of the FLS Device Control Panel, the UI opens and shows the connected device with its serial and the used COM port.



FLS-4 Parallel Virtual Port: COM3

(NB: Re-assignment of virtual serial port requires a reboot)

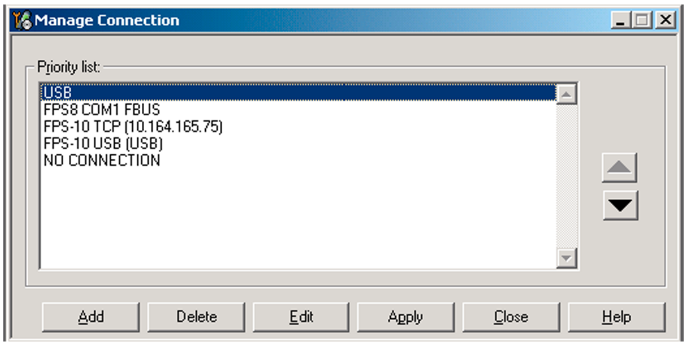
USB Flash Device Virtual Ports

Device	Serial	COM
FLS-5	274651	COM9

1 Flash Device Attached

5. To complete the configuration, click **Finish**.

6. Click the connection you want to activate. Use the up/down arrows located on the right hand side to move it on top of the list, then click **Apply**.



USB
FPS8 COM1 FBUS
FPS-10 TCP (10.164.165.75)
FPS-10 USB (USB)
NO CONNECTION

Figure 17 Connections list

The connection is activated, and it can be used after closing the *Manage Connection* window.

The connection information is shown at the right hand bottom corner of the screen.

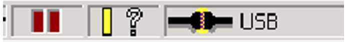
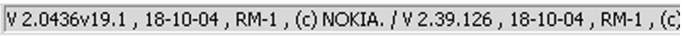


Figure 18 Connection information

7. To use the connection, connect the phone to your PC with correct service tools. Make sure the phone is switched on, and then choose **File**→**Scan Product** .

Results

The product support module information appears in the status bar:



V 2.0436v19.1 , 18-10-04 , RM-1 , (c) NOKIA. / V 2.39.126 , 18-10-04 , RM-1 , (c)

Figure 19 Product support module information (example from RM-1)

Installing flash support files for FPS-10

Prerequisites

- Install *Phoenix* service software.
- Install phone model specific data package for *Phoenix*.
- If you want to update the flash support files, they are delivered in the same installation package with *Phoenix* or newer *Phoenix* packages beginning from beginning from April 2007.

  In case you want to update the MCU files, install the latest data package (see Technical Bulletins for information on the latest one).

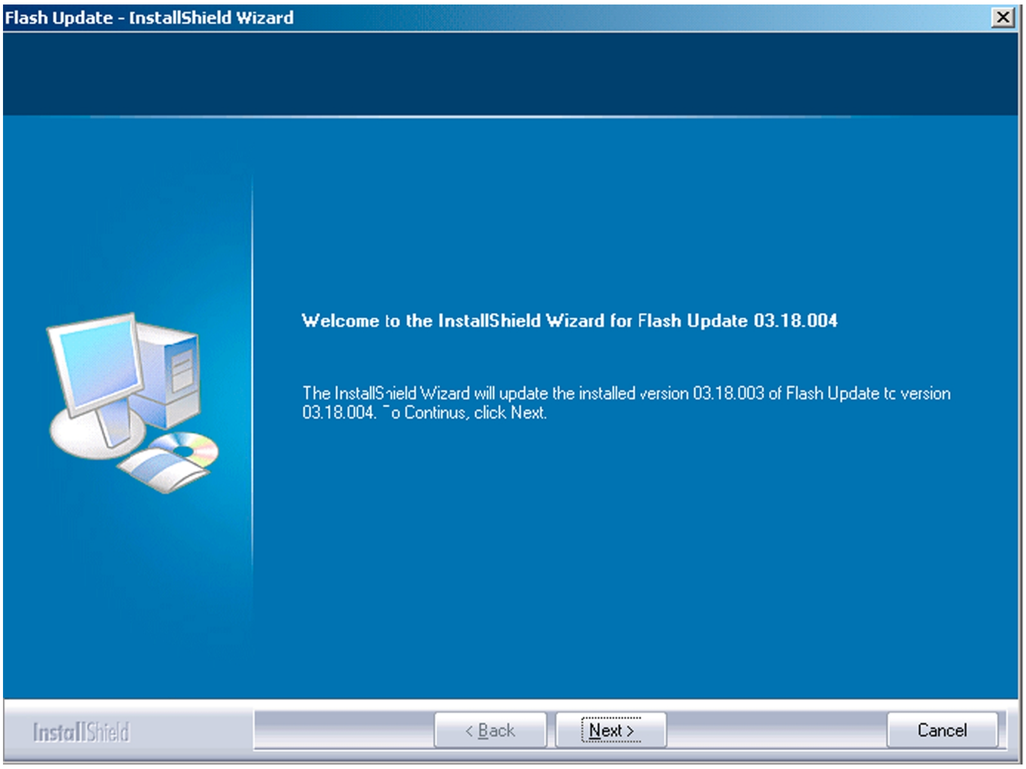
  Normally, it is enough to install *Phoenix* and the phone-specific data package because the installation always includes the latest flash update package files for FPS-10.
- A separate installation package for flash support files is available. The files can be updated according to these instructions, if updates appear between *Phoenix* data package releases.

Context

If you are not using a separate installation package, you can skip this section and continue with "Updating FPS-10 flash prommer software" (page 2–23) after installing a new phone data package.

Steps

1. To begin the installation, double-click the flash update file (for example, *flash_update_03_183_0014.exe*).



Welcome to the InstallShield Wizard for Flash Update 03.18.004

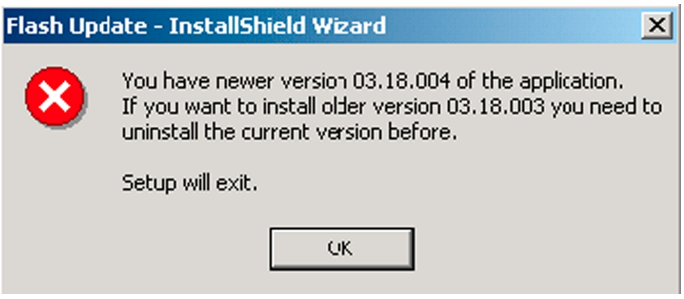
The InstallShield Wizard will update the installed version 03.18.003 of Flash Update to version 03.18.004. To Continue, click Next.

Figure 20 Flash update welcome dialog

If the same version of the flash update package already exists, and you want to reinstall it, the previous package is first uninstalled.

Restart installation again after the uninstallation.

2. If you try to downgrade the existing version to older ones, the setup will be aborted. If there is a need to downgrade the version, uninstall newer files manually from the **Windows Control Panel**, and then rerun the installation.



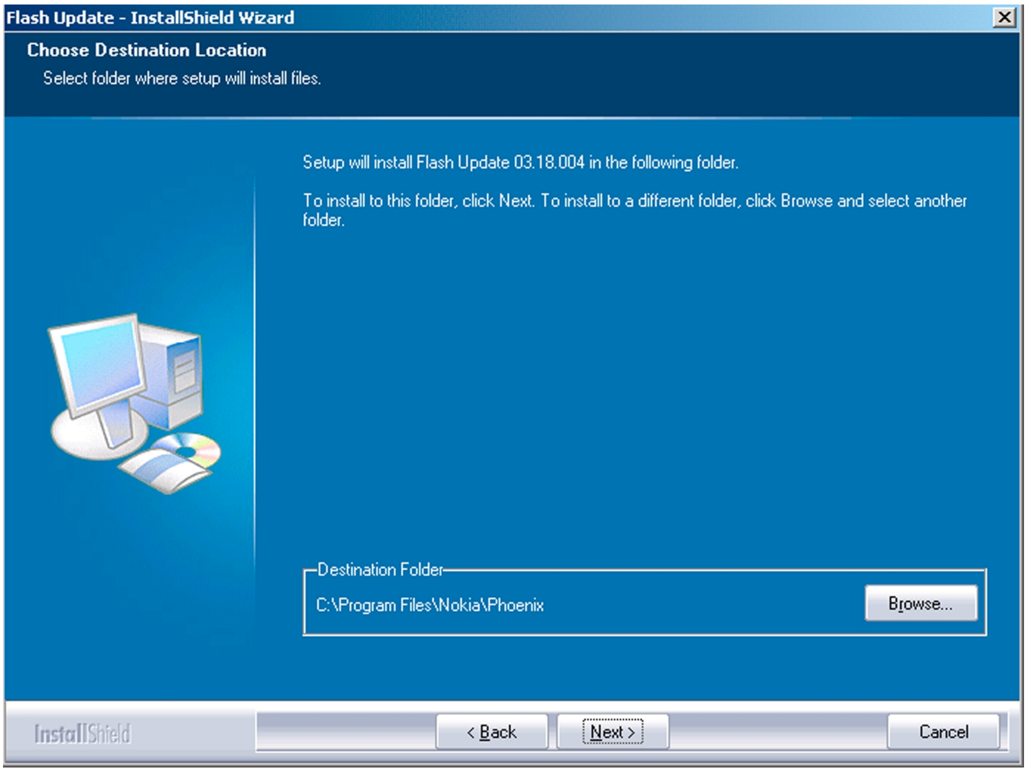
You have newer version 03.18.004 of the application.
If you want to install older version 03.18.003 you need to uninstall the current version before.

Setup will exit.

Figure 21 Flash installation interrupted

If an older version exists on your PC and it needs to be updated, click **Next** to continue installation.

3. It is recommended to install the files to the default destination folder *C:|Program Files|Nokia|Phoenix*. To continue, click **Next**.


Flash Update - InstallShield Wizard
Choose Destination Location
Select folder where setup will install files.
Destination Folder
Browse...
InstallShield
< Back
Next >
Cancel

Setup will install Flash Update 03.18.004 in the following folder.

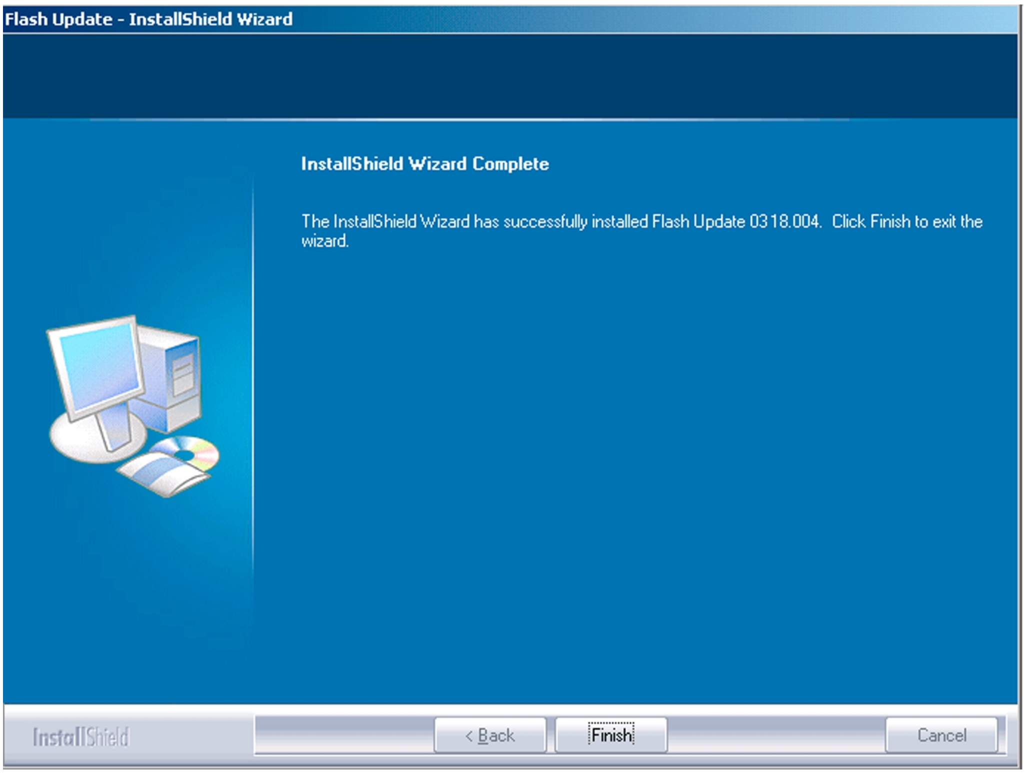
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

C:\Program Files\Nokia\Phoenix

Figure 22 Flash destination folder

When installing the flash update files for the first time, you may choose another location by selecting **Browse** (not recommended).

4. To complete the installation procedure, click **Finish** .


Flash Update - InstallShield Wizard
InstallShield
< Back
Finish
Cancel

InstallShield Wizard Complete

The InstallShield Wizard has successfully installed Flash Update 03.18.004. Click Finish to exit the wizard.

Figure 23 Finish flash update

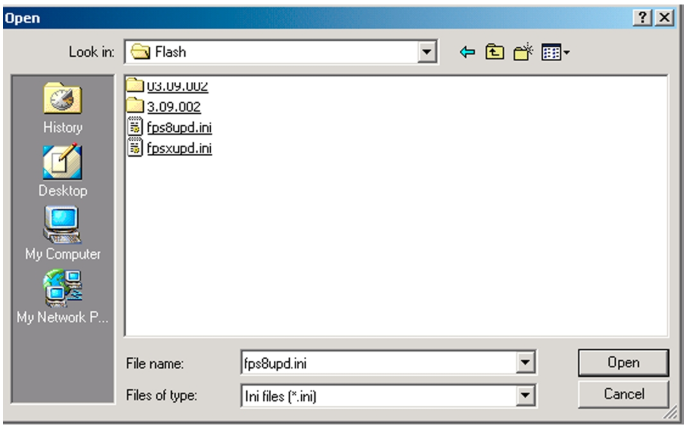
Next actions

FPS-10 flash prommer must be updated using *Phoenix*.

Updating FPS-10 flash prommer software

Steps

1. Start *Phoenix* service software, and log in.
2. Choose the correct connection for your flash prommer: **File→Manage Connections...**
3. Choose **Flashing→Prommer maintenance** .
4. To update the **FPS-10** software, click **Update**, and select the appropriate file or *fpsxupd.ini* (for FPS-10) from *C:|Program Files|Nokia|Phoenix|Flash*.


Open
History
Desktop
My Computer
My Network P...
Open
Cancel

Look in: Flash

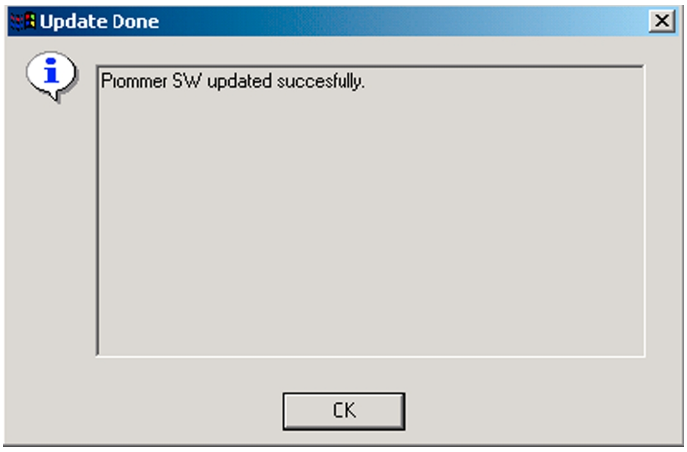
03.09.002
3.09.002
fps8upd.ini
fpsxupd.ini

File name: fps8upd.ini
Files of type: Ini files (*.ini)

Figure 24 Flash directory window

Tip: All files can be loaded separately to the prommer used. To do this, click the right mouse button in the *Flash Box Files* pane and select the file type(s) to be loaded.

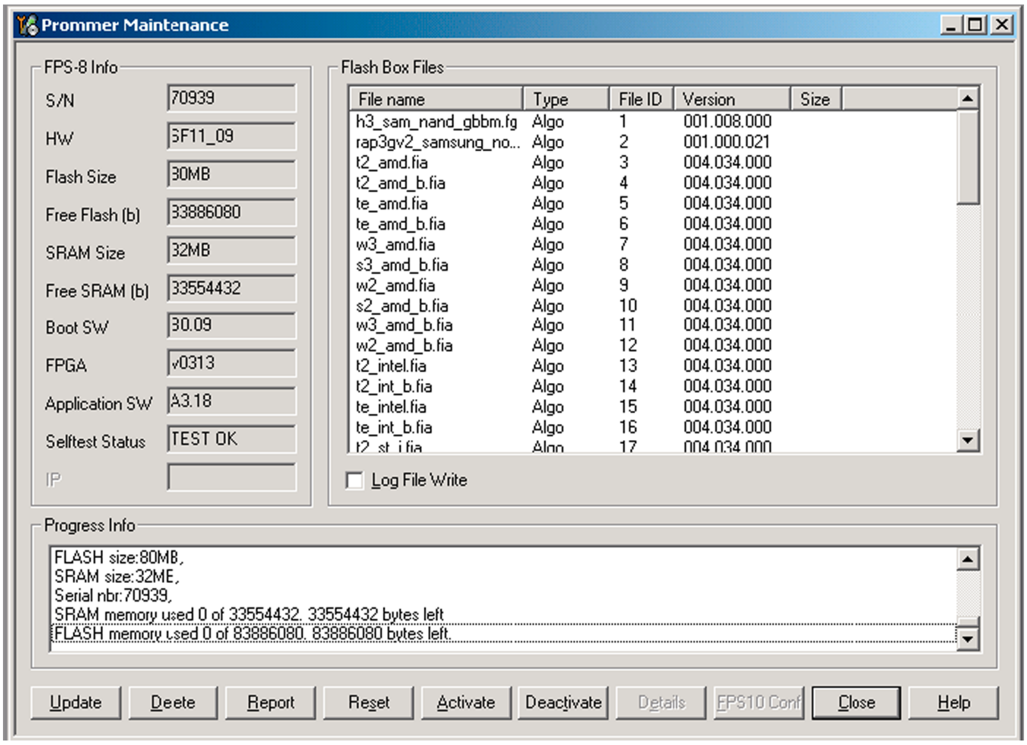
5. Click **OK**.



Prommer SW updated succesfully.

Figure 25 Prommer software update finished

6. To close the *Prommer Maintenance* window, click **Close**.



S/N 70939
HW SF11_09
Flash Size 80MB
Free Flash (b) 83886080
SRAM Size 32MB
Free SRAM (b) 33554432
Boot SW 30.09
FPGA v0313
Application SW A3.18
Selftest Status TEST OK
IP

File name	Type	File ID	Version	Size
h3_sam_nand_gbbm.fg	Algo	1	001.008.000	
rap3gv2_samsung_no...	Algo	2	001.000.021	
t2_amd.fia	Algo	3	004.034.000	
t2_amd_b.fia	Algo	4	004.034.000	
te_amd.fia	Algo	5	004.034.000	
te_amd_b.fia	Algo	6	004.034.000	
w3_amd.fia	Algo	7	004.034.000	
s3_amd_b.fia	Algo	8	004.034.000	
w2_amd.fia	Algo	9	004.034.000	
s2_amd_b.fia	Algo	10	004.034.000	
w3_amd_b.fia	Algo	11	004.034.000	
w2_amd_b.fia	Algo	12	004.034.000	
t2_intel.fia	Algo	13	004.034.000	
t2_int_b.fia	Algo	14	004.034.000	
te_intel.fia	Algo	15	004.034.000	
te_int_b.fia	Algo	16	004.034.000	
t2_st_i.fia	Algo	17	004.034.000	

☐ Log File Write

```
FLASH size:80MB,
SRAM size:32MB,
Serial nbr:70939,
SRAM memory used 0 of 33554432. 33554432 bytes left
FLASH memory used 0 of 83886080. 83886080 bytes left.
```

Figure 26 ***Prommer Maintenance*** **window**

Dead phone USB flashing

Context

This procedure is performed when the phone did not start after interrupting flashing.

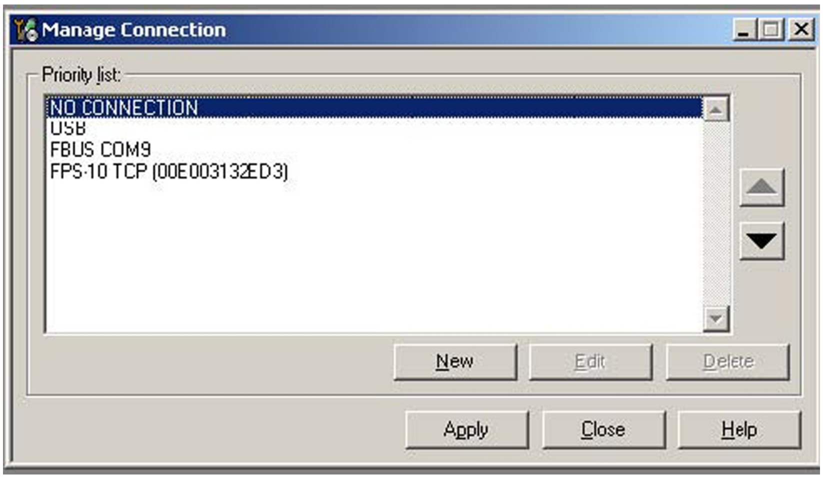
Required equipment and setup:

- Latest Phoenix software
- DKE-2 USB cable

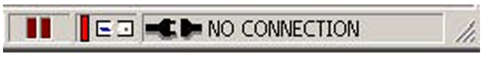
- Phone specific data package
- Phone which does not start after interrupted flash process

Steps

1. To prepare the flashing process, run Phoenix service software and log in.
2. Chose **File→Manage Connections** and activate **No Connection**. Use the up/down arrows located in the right hand side to move it on top of the list, then click **Apply**.

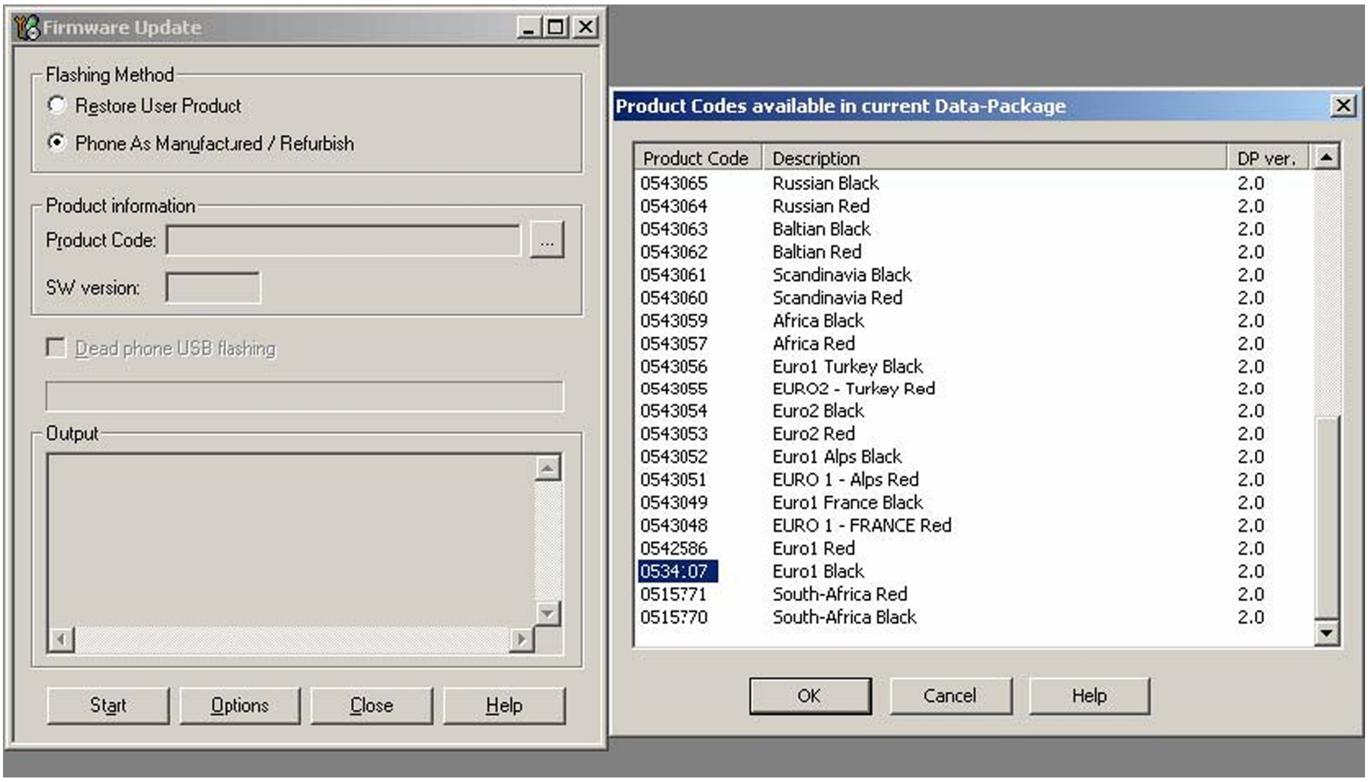

Manage Connection
Priority list:
NO CONNECTION
USB
FBUS COM9
FPS-10 TCP (00E003132ED3)
New
Edit
Delete
Apply
Close
Help

After closing the Manage Connection window the no connection symbol is shown at the right hand bottom corner of the screen.


NO CONNECTION

3. Choose the product manually from **File→Open product** and click **OK**. Wait for the phone type designator (e.g. RM-135) to be displayed in the status bar.

4. Go to **Flashing→Firmware Update** and select the correct product code by clicking on the three spots right hand next to the product code. All available product codes in the current data package are listed. Activate the correct code and click OK.

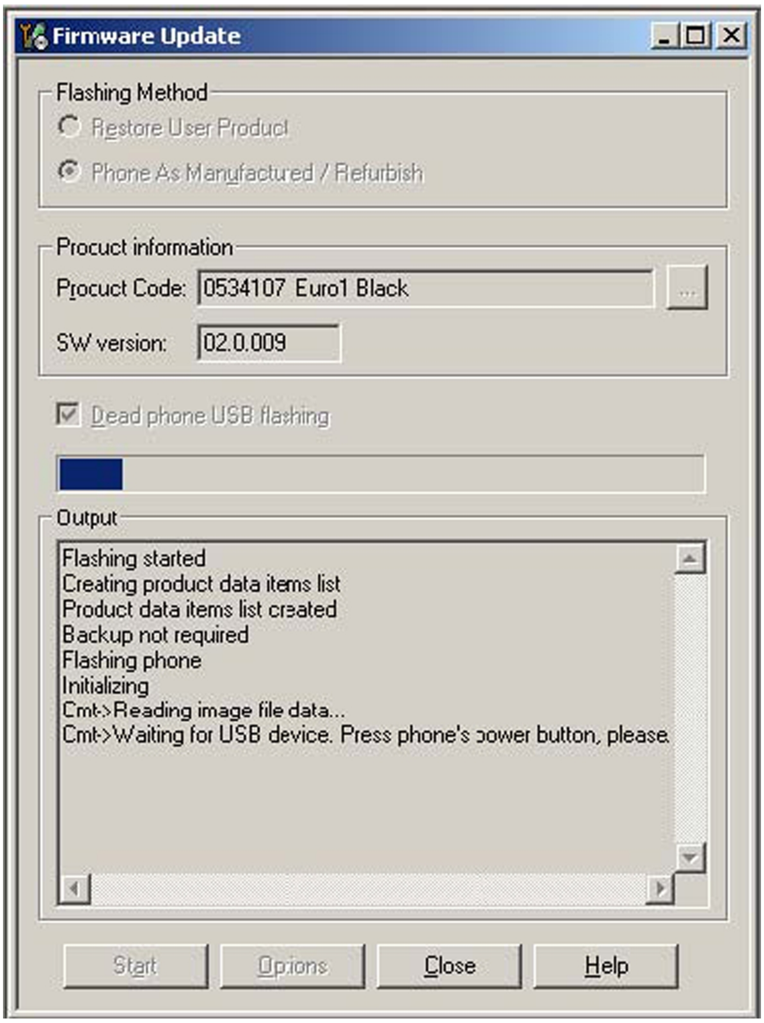

Firmware Update
Flashing Method
○ Restore User Product
● Phone As Manufactured / Refurbish
Product information
Product Code:
...
SW version:
☐ Dead phone USB flashing
Output
Start
Options
Close
Help
Product Codes available in current Data-Package
OK
Cancel
Help

Product Code	Description	DP ver.
0543065	Russian Black	2.0
0543064	Russian Red	2.0
0543063	Baltian Black	2.0
0543062	Baltian Red	2.0
0543061	Scandinavia Black	2.0
0543060	Scandinavia Red	2.0
0543059	Africa Black	2.0
0543057	Africa Red	2.0
0543056	Euro1 Turkey Black	2.0
0543055	EURO2 - Turkey Red	2.0
0543054	Euro2 Black	2.0
0543053	Euro2 Red	2.0
0543052	Euro1 Alps Black	2.0
0543051	EURO 1 - Alps Red	2.0
0543049	Euro1 France Black	2.0
0543048	EURO 1 - FRANCE Red	2.0
0542586	Euro1 Red	2.0
0534:07	Euro1 Black	2.0
0515771	South-Africa Red	2.0
0515770	South-Africa Black	2.0

The chosen product code is now shown with the software version according to the installed data package.

5. Select **Dead Phone USB Flashing** and connect the phone via USB cable.
6. Start the flashing process by clicking **Start**.

   Flashing started and after a few seconds Phoenix wants to open a connection to the phone. Press the power button of the phone if you are asked to. The flash process continues. Otherwise, flashing failed and the procedure has to be repeated.


Firmware Update
Flashing Method
Product information
Output
Start
Options
Close
Help

○ Restore User Product
● Phone As Manufactured / Refurbish

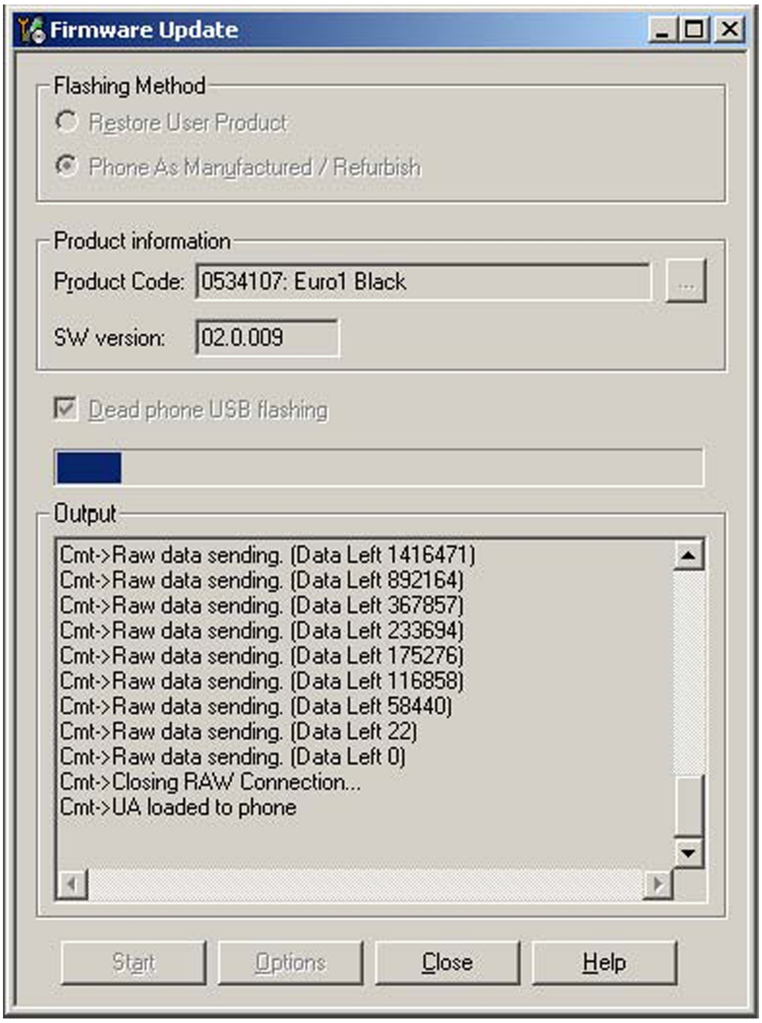
Product Code: 0534107 Euro1 Black

SW version: 02.0.009

☑ Dead phone USB flashing

```
Flashing started
Creating product data items list
Product data items list created
Backup not required
Flashing phone
Initializing
Cmt->Reading image file data...
Cmt->Waiting for USB device. Press phone's power button, please.
```

After pressing the power button:


Firmware Update
Flashing Method
○ Restore User Product
● Phone As Manufactured / Refurbish
Product information
Dead phone USB flashing
Output
Start
Options
Close
Help

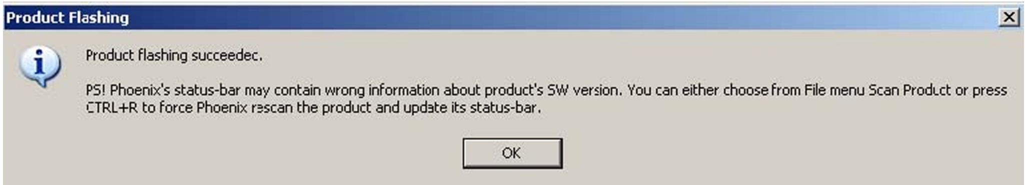
Product Code: 0534107: Euro1 Black

SW version: 02.0.009

☑ Dead phone USB flashing

```
Cmt->Raw data sending. (Data Left 1416471)
Cmt->Raw data sending. (Data Left 892164)
Cmt->Raw data sending. (Data Left 367857)
Cmt->Raw data sending. (Data Left 233694)
Cmt->Raw data sending. (Data Left 175276)
Cmt->Raw data sending. (Data Left 116858)
Cmt->Raw data sending. (Data Left 58440)
Cmt->Raw data sending. (Data Left 22)
Cmt->Raw data sending. (Data Left 0)
Cmt->Closing RAW Connection...
Cmt->UA loaded to phone
```

Progress messages on the screen show actions during phone programming, please wait. Programming is completed when Flashing Completed message is displayed.


Product Flashing
OK

Product flashing succeeded.

PS! Phoenix's status-bar may contain wrong information about product's SW version. You can either choose from File menu Scan Product or press CTRL+R to force Phoenix rescan the product and update its status-bar.

3 — Service Tools and Service Concepts

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Table of Contents

Service tools 3–5
  Product specific tools 3–5
    FS-23 3–5
    MJ-93 3–6
    RJ-111 3–7
    SA-102 3–8
    SS-112 3–8
  General tools 3–8
    CU-4 3–9
    FLS-5 3–10
    FPS-10 3–10
    PK-1 3–10
    PKD-1 3–10
    RJ-104 3–11
    RJ-157 3–11
    RJ-160 3–11
    RJ-169 3–11
    RJ-93 3–12
    SB-6 3–12
    SPS-1 3–12
    SRT-6 3–12
    SS-46 3–12
    SS-62 3–13
    SS-93 3–13
    ST-37 3–13
    ST-40 3–13
    ST-55 3–13
    SX-4 3–14
  Cables 3–14
    CA-31D 3–14
    CA-35S 3–14
    CA-58RS 3–15
    DAU-9S 3–15
    DKE-2 3–15
    PCS-1 3–15
    XCS-4 3–16
    XRF-1 3–16
    XRS-6 3–16
  Service tools spare parts 3–16
    Coax cable assy for MJ-93 3–16
    Spare UI flex unit for MJ-93 3–17
Service concepts 3–17
  POS (Point of Sale) flash concept 3–17
  Flash concept with FPS-10 3–18
  Flash concept with FLS-5 and SS-46 3–19
  CU-4 flash concept with FPS-10 3–20
  Flash concept with FLS-5 and SS-62 3–21
  Flash concept with FLS-5 and module jig 3–22
  Module jig service concept 3–23
  Service concept for RF testing and RF/BB tuning 3–24

RF testing / BB tuning concept 3–25
RF/BB tuning and flashing with FPS-10 3–26
RF/BB tuning and flashing with FLS-5 3–27
Bluetooth test concept with SB-6 3–28
Connecting to flash adapter 3–29

List of Tables

Table 1 MJ-93 attenuation table 3–6
Table 2 SA-102 attenuation table 3–8

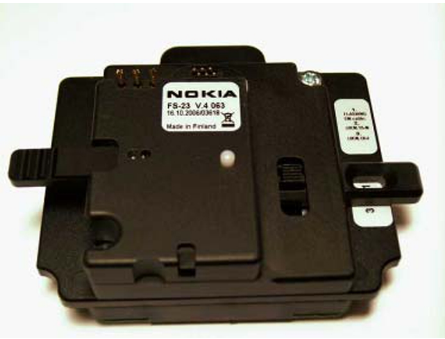
List of Figures

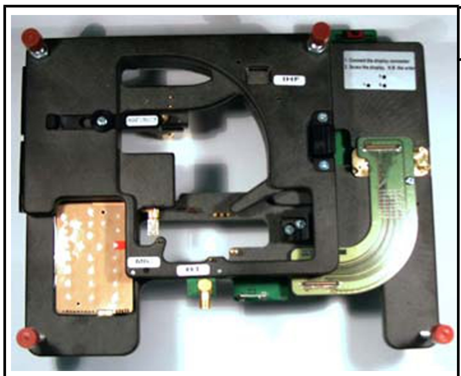
Figure 27 POS flash concept 3–17
Figure 28 Basic flash concept with FPS-10 3–18
Figure 29 Flash concept with FLS-5 and SS-46 3–19
Figure 30 CU-4 flash concept with FPS-10 3–20
Figure 31 Basic flash concept with FLS-5 and SS-62 3–21
Figure 32 Flash concept with FLS-5 and module jig 3–22
Figure 33 Module jig service concept 3–23
Figure 34 Service concept for RF testing and RF/BB tuning 3–24
Figure 35 RF testing / BB tuning concept 3–25
Figure 36 RF/BB tuning and flashing with FPS-10 3–26
Figure 37 RF/BB tuning and flashing with FLS-5 3–27
Figure 38 Bluetooth test concept with SB-6 3–28

Service tools

Product specific tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-135, refer to various concepts.

	FS-23	Flash adapter	
	FS-23 is a product specific adapter for SW update and testing purposes. It is compatible to SS-62 and SS-46. It provides galvanic connetion to terminal test pads and battery connector.		



MJ-93	Module jig	

The module jig offers engine module component level repair, analysis and alignment capabilities in combination with CU-4.

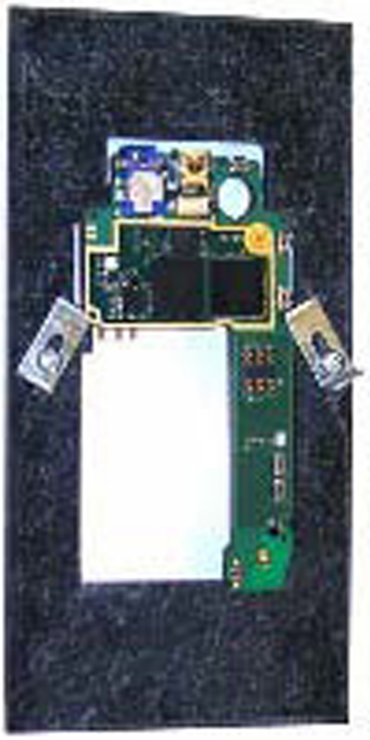
Features:

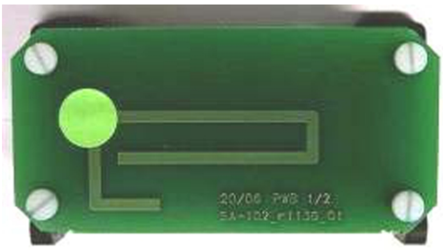
- connection interfaces for GSM, WCDMA and Bluetooth antenna
- galvanic connection to engine module test pads
- multiplexing between USB an FBUS media, controlled by VUSB with CU-4
- lid interconnection with test points for measurements
- connection to lid assembly incl. displays and earpiece
- connector for e.g. CU-4 control unit
- connection for BT / SIM / SD-card module

Note: Lid assembly incl. displays is not designed to be used for repair and analysis. The connection cycles for lid are limited to 10 times.

- **Table 1 MJ-93 attenuation table**

Band	Channel	Frequency / MHz	Loss / dB
GSM850	189	836.6	0.20
GSM850	189	881.6	0.20
GSM900	37	897.4	0.20
GSM900	37	942.4	0.20
GSM1800	700	1747.8	0.20
GSM1800	700	1842.8	0.20
GSM1900	661	1880	0.20
WCDMA1	9750	1950	0.20
GSM1900	661	1960	0.20
WCDMA1	10700	2140	0.20

	RJ-111	Soldering jig	
	RJ-111 is a jig to support component level exchange with soldering machines for the engine module.		



SA-102 | RF coupler

SA-102 is an RF coupler for WCDMA and GSM RF testing. It is used together with the product-specific flash adapter.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connector of SA-102 (+ / - 2dB):

- **Table 2 SA-102 attenuation table**

Band		Channel UP/ DOWN	TX f [MHz]	TX Loss [dB]	RX f [MHz]	RX Loss (dB)
GSM850	Low	128	824.2	12.0	869.2	10.0
	Mid	189	836.4	11.3	881.4	9.5
	High	251	848.8	10.5	893.8	9.0
EGSM900	Low1	975	880.2	9.5	925.2	10.7
	Low2	1	890.2	9.3	935.2	11.0
	Mid	37	897.4	9.0	942.4	11.2
	High	124	915.8	9.5	960.8	12.0
GSM1800	Low	512	1710.2	7.6	1805.2	6.7
	Mid	698	1747.4	7.3	1842.4	6.4
	High	885	1784.8	7.0	1879.8	6.5
GSM1900	Low	512	1850.2	6.3	1930.2	7.5
	Mid	661	1880.0	6.6	1960.0	8.0
	High	810	1909.8	7.0	1989.8	8.6
WCDMA I	Low	9613 / 10563	1922.4	7.3	2112.4	15.8
	Mid	9750 / 10700	1950.0	7.9	2140.0	18.0
	High	9887 / 10837	1977.6	8.3	2167.6	20.0

Note: It is recommended to add a 3dB attenuator directly at coupler SMA connector.

SS-112 | Camera recess 00 bit

¼” bit for the Torque screwdriver to be added as part of the service box.

General tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-135, refer to various concepts.

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

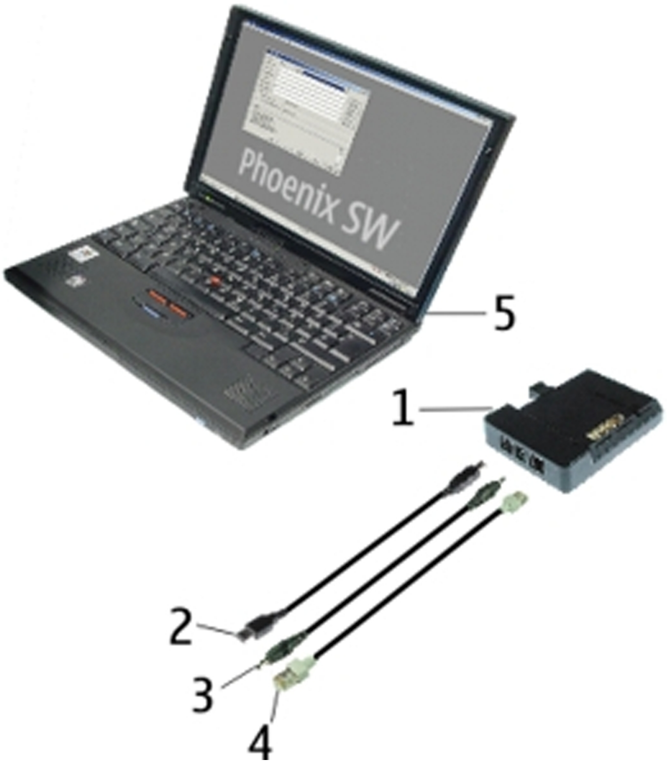
1 Connect a service tool (jig, flash adapter) to CU-4.

2 Connect CU-4 to your PC with a USB cable.

3 Connect supply voltage (12 V)

4 Connect an FBUS cable (if necessary).

5 Start Phoenix service software.



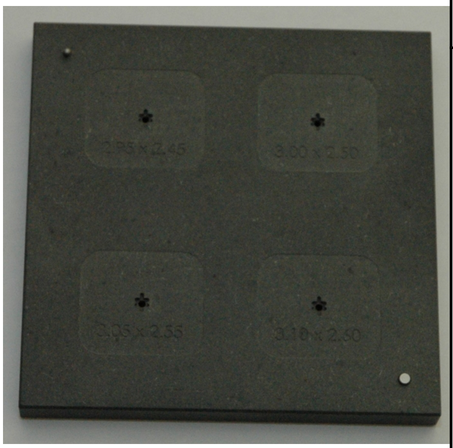
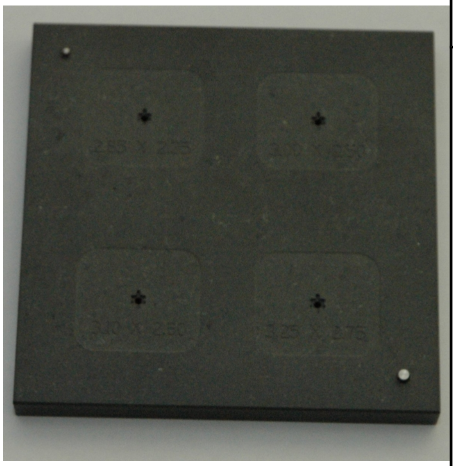
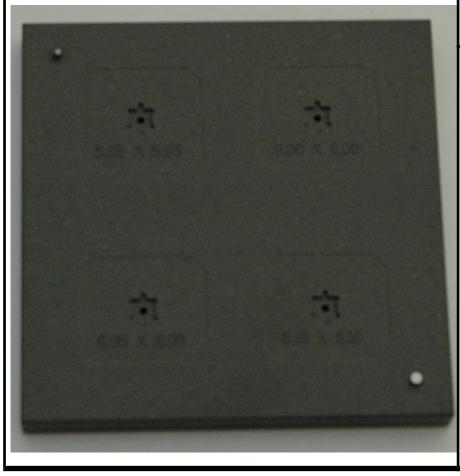
Note: Phoenix enables CU-4 regulators via USB when it is started.

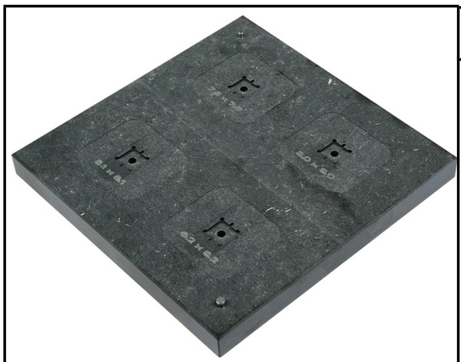
Reconnecting the power supply requires a Phoenix restart.

<table>
<tr><td rowspan="2">

NOKIA
FLS-5
Pre Production

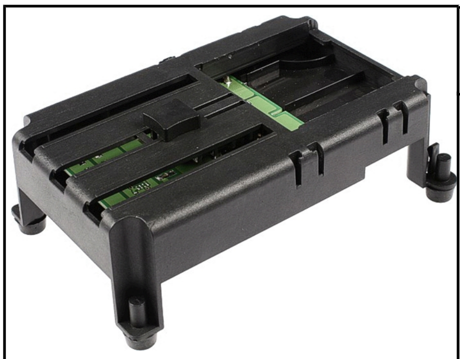
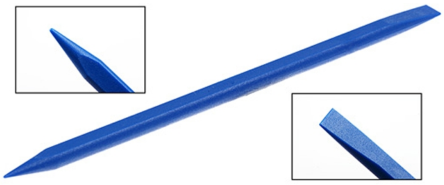
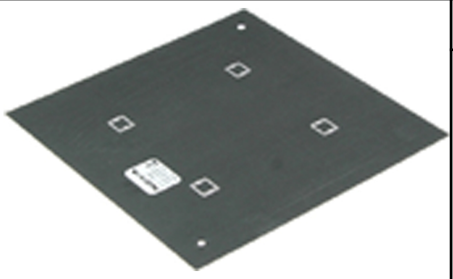
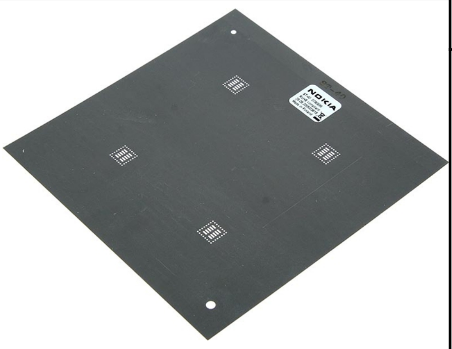
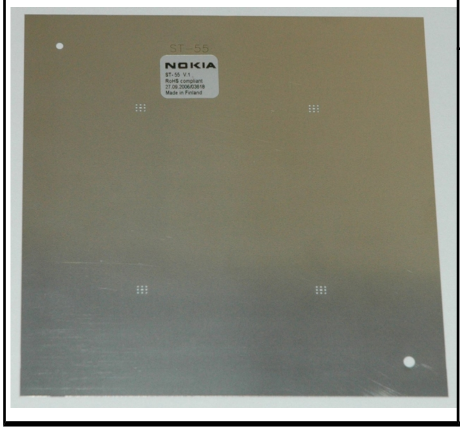
</td><td>FLS-5</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.</td></tr>
<tr><td rowspan="2"> </td><td>FPS-10</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-10 interfaces with:
• PC
• Control unit
• Flash adapter
• Smart card
FPS-10 flash prommer features:
• Flash functionality for BB5 and DCT-4 terminals
• Smart Card reader for SX-2 or SX-4
• USB traffic forwarding
• USB to FBUS/Flashbus conversion
• LAN to FBUS/Flashbus and USB conversion
• Vusb output switchable by PC command
FPS-10 sales package includes:
• FPS-10 prommer
• Power Supply with 5 country specific cords
• USB cable</td></tr>
<tr><td rowspan="2"> </td><td>PK-1</td><td>Software protection key</td><td></td></tr>
<tr><td colspan="3">PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.
PK-1 is meant for use with a PC that does not have a series interface.
To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</td></tr>
<tr><td rowspan="2"> </td><td>PKD-1</td><td>SW security device</td><td></td></tr>
<tr><td colspan="3">SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.
Without the device, it is not possible to use the service software.
Printer or any such device can be connected to the PC through the device if needed.</td></tr>
</table>

	RJ-104	Rework jig	
	RJ-104 is a rework jig used when servicing the BTHFM (D6000) module. It is used together with rework stencil ST-37.		
	RJ-157	Rework jig	
	RJ-157 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-55 stencil.		
	RJ-160	Rework jig	
	RJ-160 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-55 stencil.		
	RJ-169	Rework jig	
	RJ-169 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-59 stencil.		

<table>
<tr><td rowspan="2"></td><td>RJ-93</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-93 is used as a rework jig for the Front End Module (FEM).
This rework jig takes the FEM or power amplifier (PA) module (N7520) for spreading the soldering paste to the component. Must be used together with the ST-40 stencil.</td></tr>
<tr><td rowspan="2">

NOKIA
RF-I/O
CLASS 1
STATUS
BER TEST
FBUS
POWER

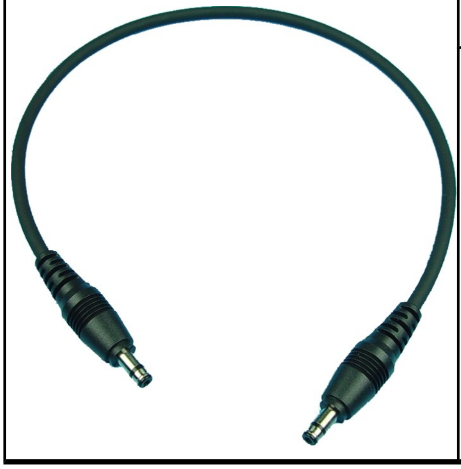
</td><td>SB-6</td><td>Bluetooth test and interface box (sales package)</td><td></td></tr>
<tr><td colspan="3">The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .
Sales package includes:
• SB-6 test box
• Installation and warranty information</td></tr>
<tr><td rowspan="2"></td><td>SPS-1</td><td>Soldering Paste Spreader</td><td></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2"> </td><td>SRT-6</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SRT-6 is used to open phone covers and B-to-B connectors.</td></tr>
<tr><td rowspan="2"> </td><td>SS-46</td><td>Interface adapter</td><td></td></tr>
<tr><td colspan="3">SS-46 acts as an interface adapter between the flash adapter and FPS-10.</td></tr>
</table>

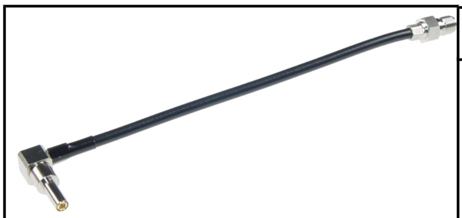
<table>
<tr><td rowspan="2"></td><td>SS-62</td><td>Generic flash adapter base for BB5</td><td></td></tr>
<tr><td colspan="3">• generic base for flash adapters and couplers
• SS-62 equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using galvanic connector or coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2"></td><td>SS-93</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SS-93 is used for opening JAE connectors.</td></tr>
<tr><td rowspan="2"></td><td>ST-37</td><td>BTHFM rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-37 stencil is used with the RJ-104 rework jig to service the BTHFM (D6000) module.</td></tr>
<tr><td rowspan="2"></td><td>ST-40</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-40 is a rework stencil that is used with the RJ-93 rework jig to service the Front End Module (N7520).</td></tr>
<tr><td rowspan="2"></td><td>ST-55</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-55 is a rework stencil used with rework jig RJ-157 and RJ-160.</td></tr>
</table>

	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.		

Cables

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-135, refer to various concepts.

	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.		
	CA-35S	Power cable	
	CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.		

<table>
<tr><td rowspan="2"></td><td>CA-58RS</td><td>RF tuning cable</td><td></td></tr>
<tr><td colspan="3">RF tuning cable for use with a flash adapter.
CA-58RS RF cable extends adapter features to allow RF function tests and RF tuning in GSM bands.
Features include:
• easy to use together with flash adapter or even stand alone
• most accurate RF connection to phone module under test
• most accurate RF connection to phone module under test
• low attenuation and small “ripple” over the width of each GSM band
Note: The RF cable must be used for RF tuning.</td></tr>
<tr><td rowspan="2"> </td><td>DAU-9S</td><td>MBUS cable</td><td></td></tr>
<tr><td colspan="3">The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.
Note: Docking station adapters valid for DCT4 products.</td></tr>
<tr><td rowspan="2">

NOKIA
Type DKE-2

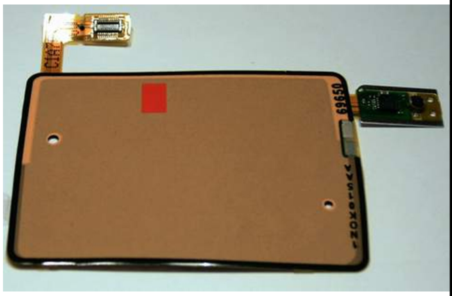
</td><td>DKE-2</td><td>Mini-USB cable</td><td></td></tr>
<tr><td colspan="3">USB to mini-USB connector cable.</td></tr>
<tr><td rowspan="2"> </td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled operating voltage.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
<tr><td rowspan="2"> </td><td>XRF-1</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector ca. 610mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB
• WLAN: 0.6+-0.1dB</td></tr>
<tr><td rowspan="2"> </td><td>XRS-6</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector approximately 610 mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB
• WLAN: 0.6+-0.1dB</td></tr>
</table>

Service tools spare parts

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-135, refer to various concepts.

<table>
<tr><td rowspan="2"> </td><td></td><td>Coax cable assy for MJ-93</td><td></td></tr>
<tr><td colspan="3">Spare part for MJ-93.</td></tr>
</table>

		Spare UI flex unit for MJ-93	
	Spare part for MJ-93.		

Service concepts

POS (Point of Sale) flash concept

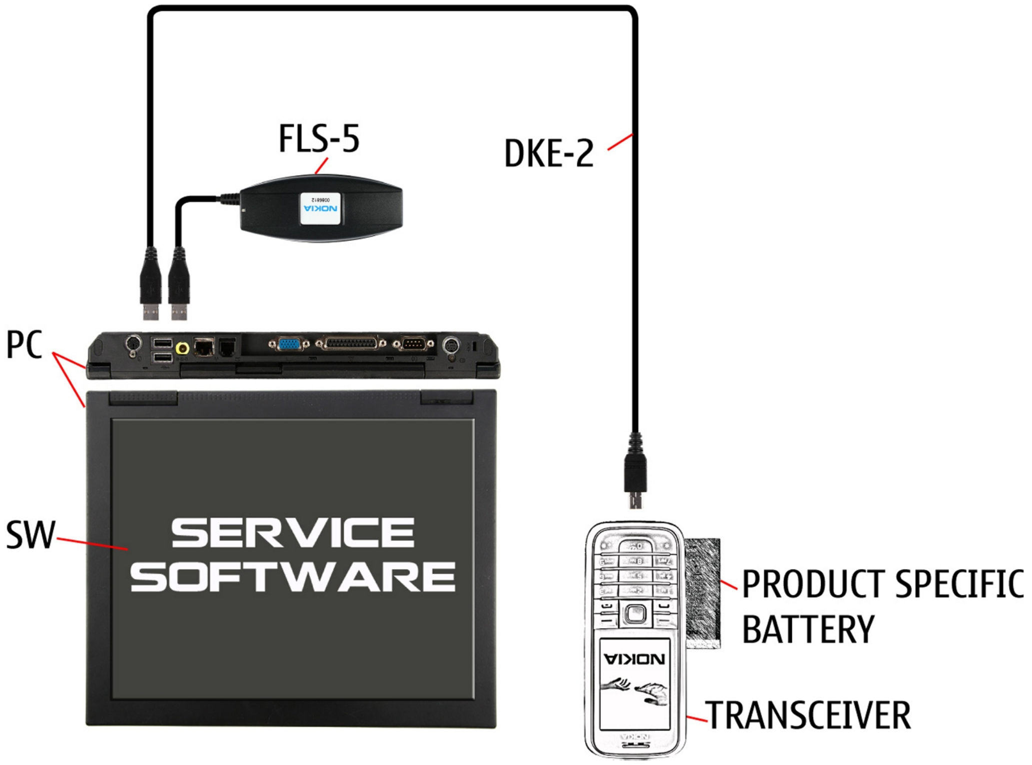

FLS-5
DKE-2
PC
SW
SERVICE SOFTWARE
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Figure 27 POS flash concept

Type	Description
Product specific tools	
BL-4B	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
DKE-2	USB connectivity cable

Flash concept with FPS-10

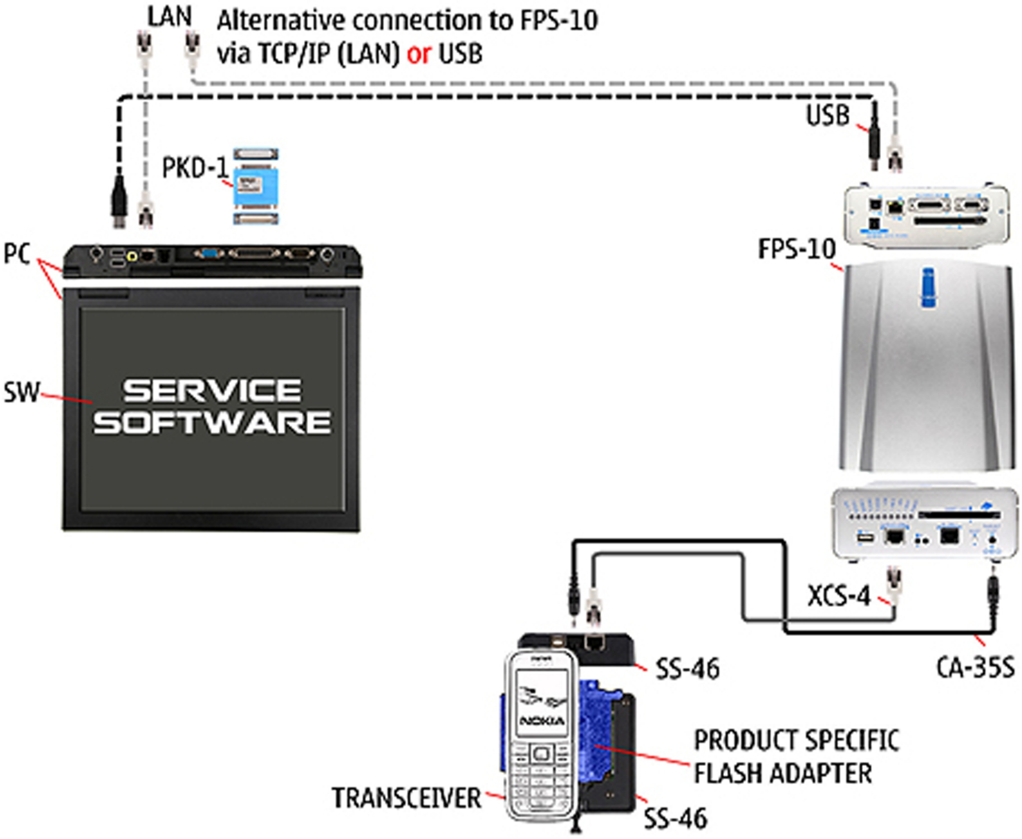

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
SW
SERVICE
SOFTWARE
FPS-10
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 28 Basic flash concept with FPS-10

Type	Description
Product specific tools	
FS-23	Flash adapter
Other tools	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

Flash concept with FLS-5 and SS-46

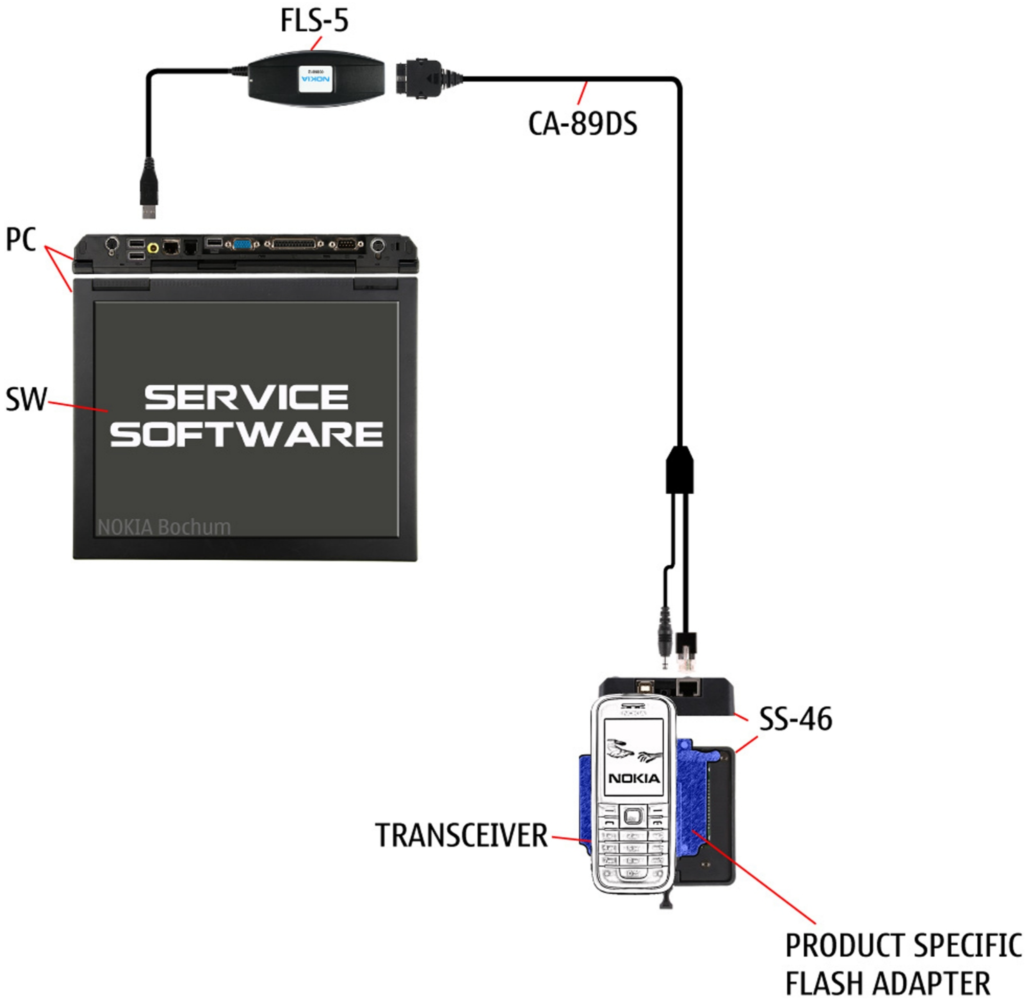

FLS-5
CA-89DS
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
SS-46
TRANSCEIVER
PRODUCT SPECIFIC
FLASH ADAPTER

Figure 29 Flash concept with FLS-5 and SS-46

Type	Description
Product specific tools	
FS-23	Flash adapter
Other tools	
ACF-8	Universal power supply (not shown in the concept picture)
FLS-5	POS flash dongle
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
CA-89DS	Cable

CU-4 flash concept with FPS-10

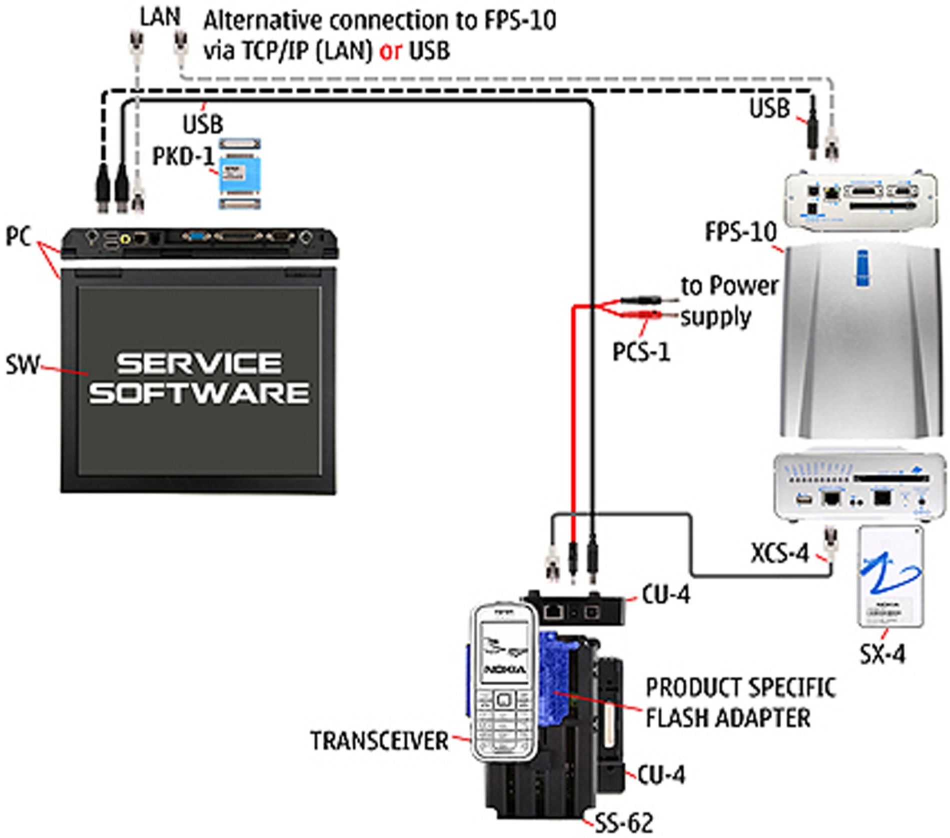

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
USB
PC
SW
SERVICE SOFTWARE
FPS-10
to Power supply
PCS-1
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
SS-62

Figure 30 CU-4 flash concept with FPS-10

Type	Description
Product specific tools	
FS-23	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

Flash concept with FLS-5 and SS-62

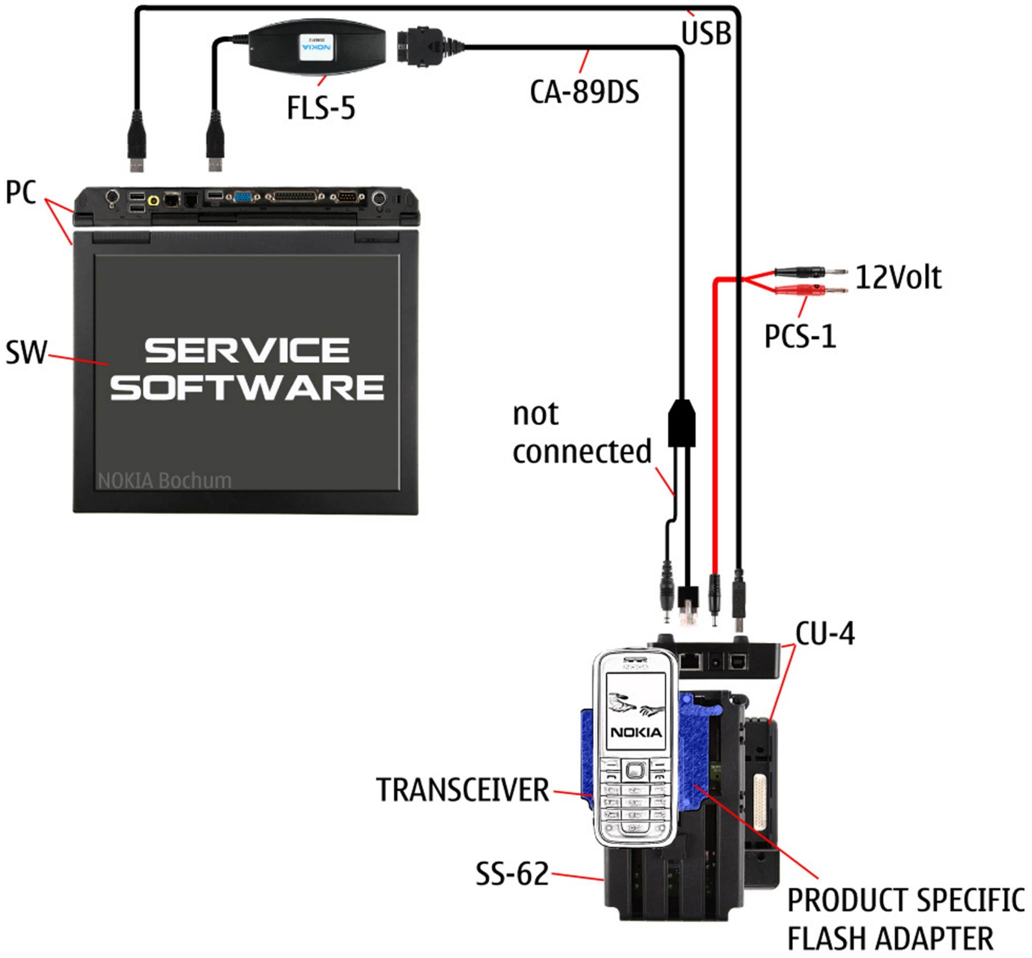

USB
FLS-5
CA-89DS
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
12Volt
PCS-1
not connected
CU-4
TRANSCEIVER
SS-62
PRODUCT SPECIFIC FLASH ADAPTER

Figure 31 Basic flash concept with FLS-5 and SS-62

Type	Description
Product specific tools	
FS-23	Flash adapter
Other tools	
CU-4	Control unit
FLS-5	POS flash dongle
SS-62	Flash adapter base
	PC with Phoenix service software
Cables	
CA-89DS	Cable
PCS-1	Power cable
	Standard USB cable
	USB cable

Flash concept with FLS-5 and module jig

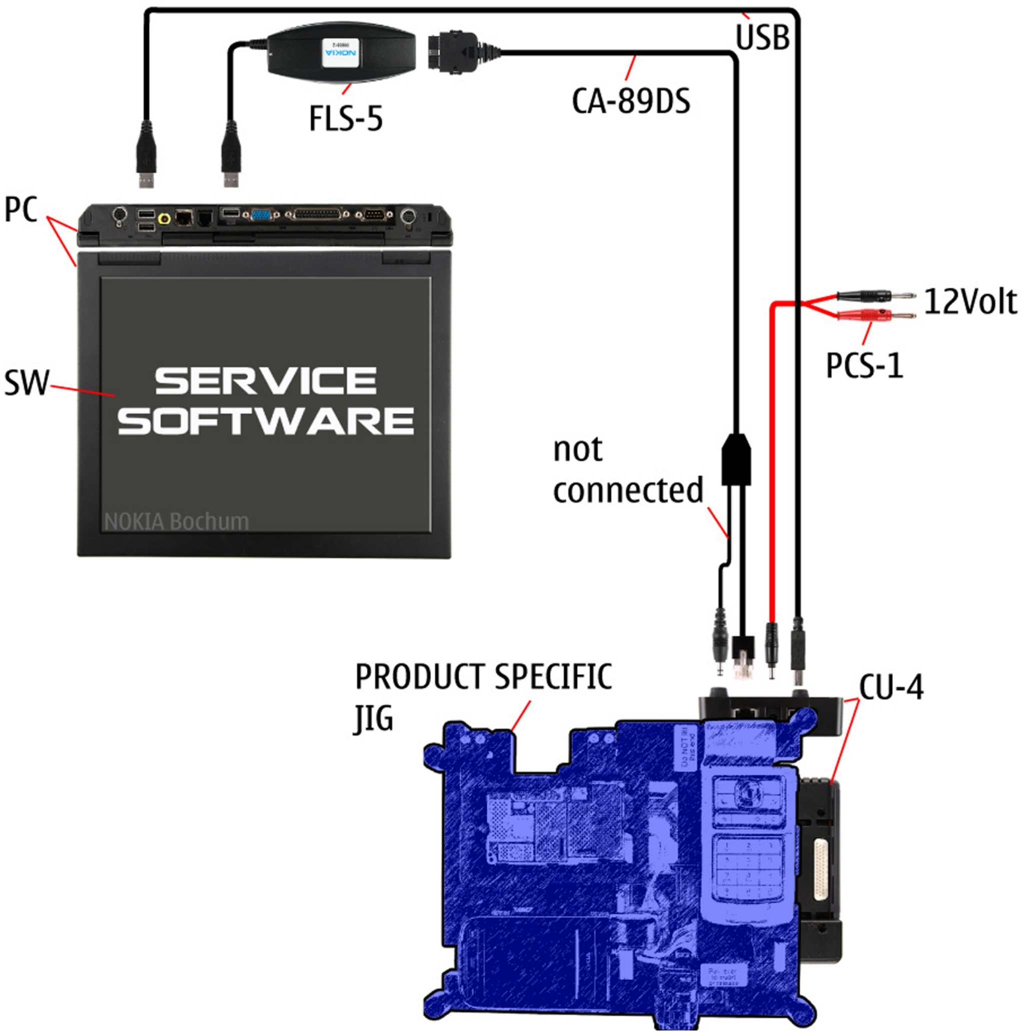

USB
FLS-5
CA-89DS
PC
12Volt
PCS-1
SW
SERVICE SOFTWARE
NOKIA Bochum
not connected
PRODUCT SPECIFIC JIG
CU-4

Figure 32 Flash concept with FLS-5 and module jig

Type	Description
Product specific tools	
MJ-93	Module jig
Other tools	
CU-4	Control unit
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-89DS	Cable
PCS-1	DC power cable
	USB cable

Module jig service concept

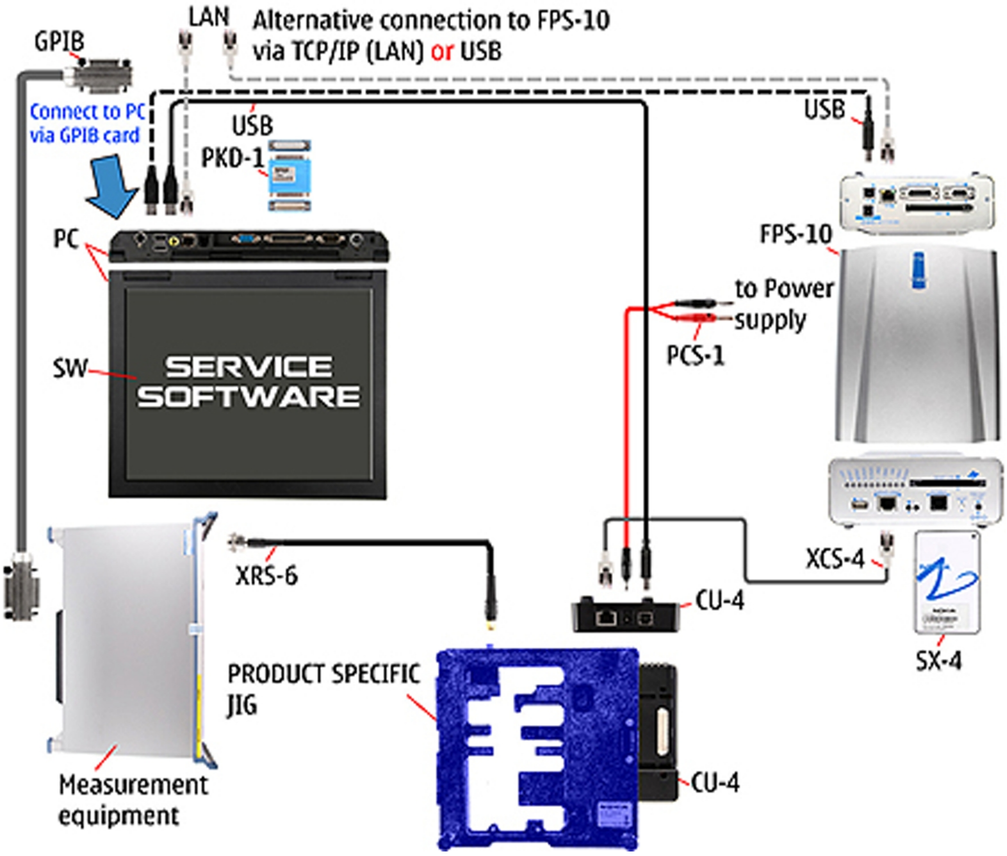

LAN
Alternative connection to FPS-10 via TCP/IP (LAN) or USB
GPIB
Connect to PC via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power supply
PCS-1
SW
SERVICE SOFTWARE
XRS-6
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC JIG
Measurement equipment
CU-4

Figure 33 Module jig service concept

Type	Description
Phone specific tools	
MJ-93	Module jig
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
	USB cable

Type	Description
	GPIB control cable

Service concept for RF testing and RF/BB tuning

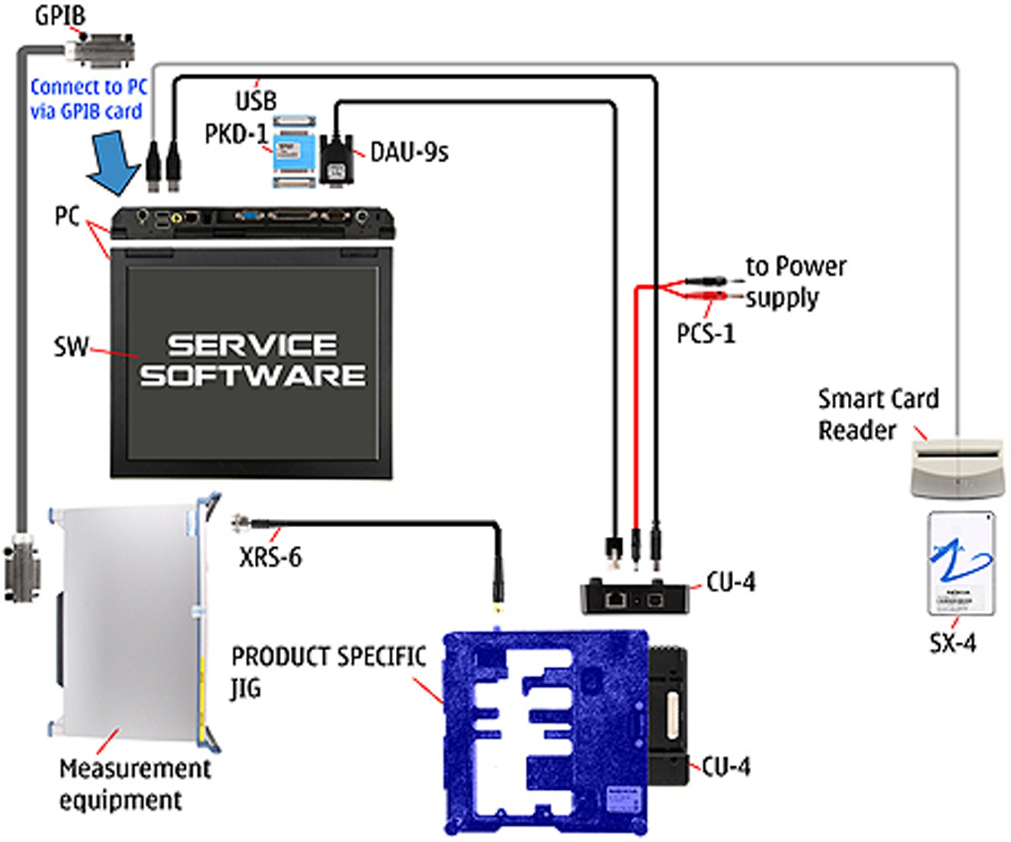

GPIB
Connect to PC via GPIB card
USB
PKD-1
DAU-9s
PC
to Power supply
PCS-1
SW
SERVICE SOFTWARE
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC JIG
CU-4
Measurement equipment

Figure 34 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific tools	
MJ-93	Module jig
Other tools	
CU-4	Control unit
PKD-1/PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9s	MBUS cable
PCS-1	DC power cable

Type	Description
XRS-6	RF cable
	GPIB control cable
	USB cable

RF testing / BB tuning concept

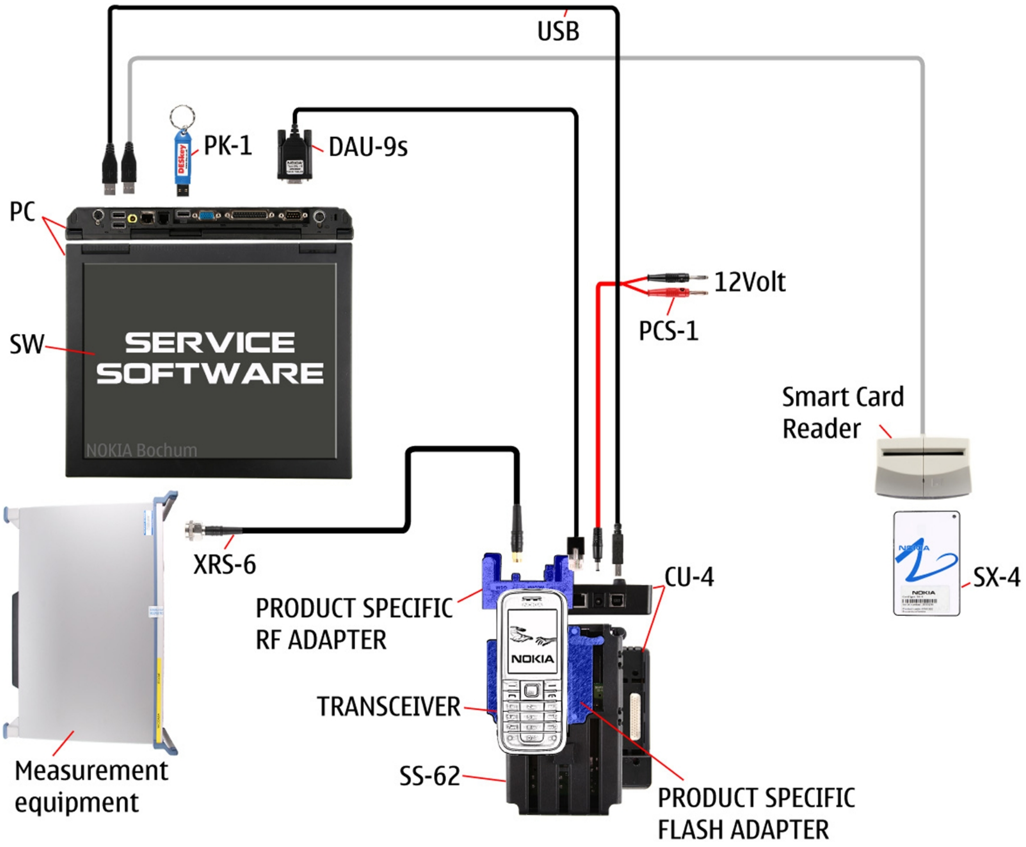

USB
PK-1
DAU-9s
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
12Volt
PCS-1
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC RF ADAPTER
TRANSCEIVER
SS-62
Measurement equipment
PRODUCT SPECIFIC FLASH ADAPTER

Figure 35 RF testing / BB tuning concept

Type	Description
Product specific tools	
FS-23	Flash adapter
SA-102	RF coupler
Other tools	
CU-4	Control unit
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software

Type	Description
Cables	
DAU-9s	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	USB cable

RF/BB tuning and flashing with FPS-10

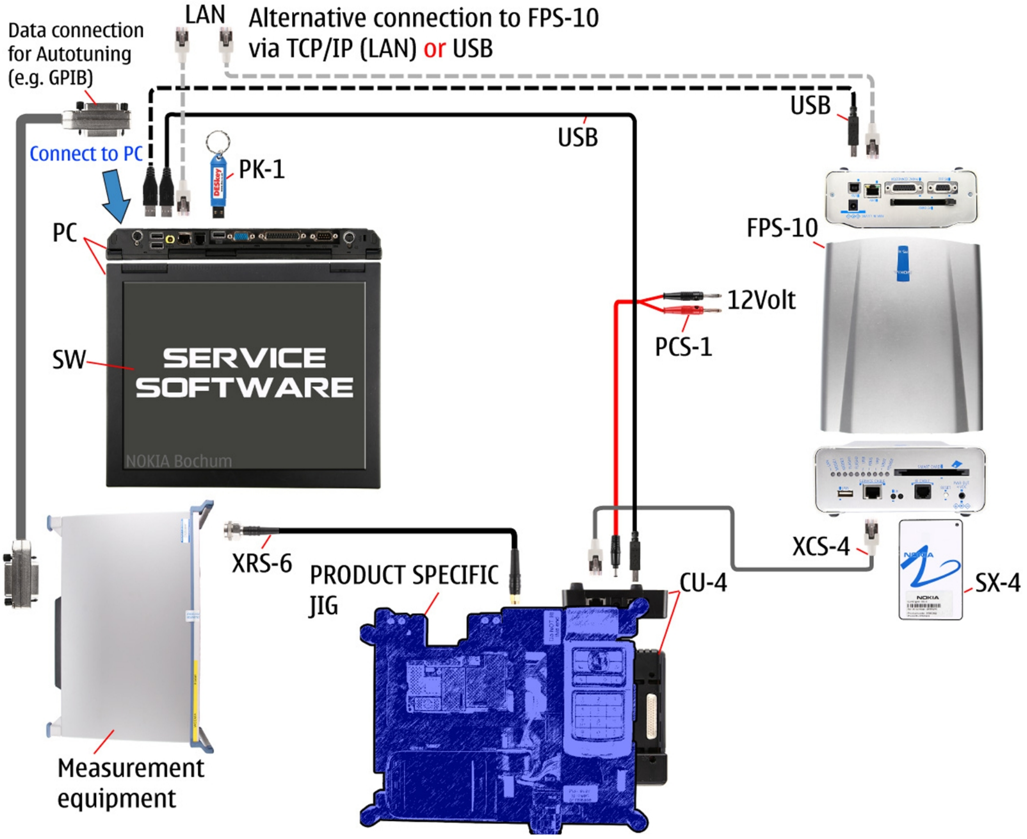

Data connection
for Autotuning
(e.g. GPIB)
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
USB
Connect to PC
PK-1
PC
FPS-10
12Volt
PCS-1
SW
SERVICE
SOFTWARE
NOKIA Bochum
XCS-4
XRS-6
PRODUCT SPECIFIC
JIG
CU-4
SX-4
Measurement
equipment

Figure 36 RF/BB tuning and flashing with FPS-10

Type	Description
Product specific tools	
MJ-93	Module jig
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	PC with Phoenix service software

Type	Description
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
	USB cable

RF/BB tuning and flashing with FLS-5

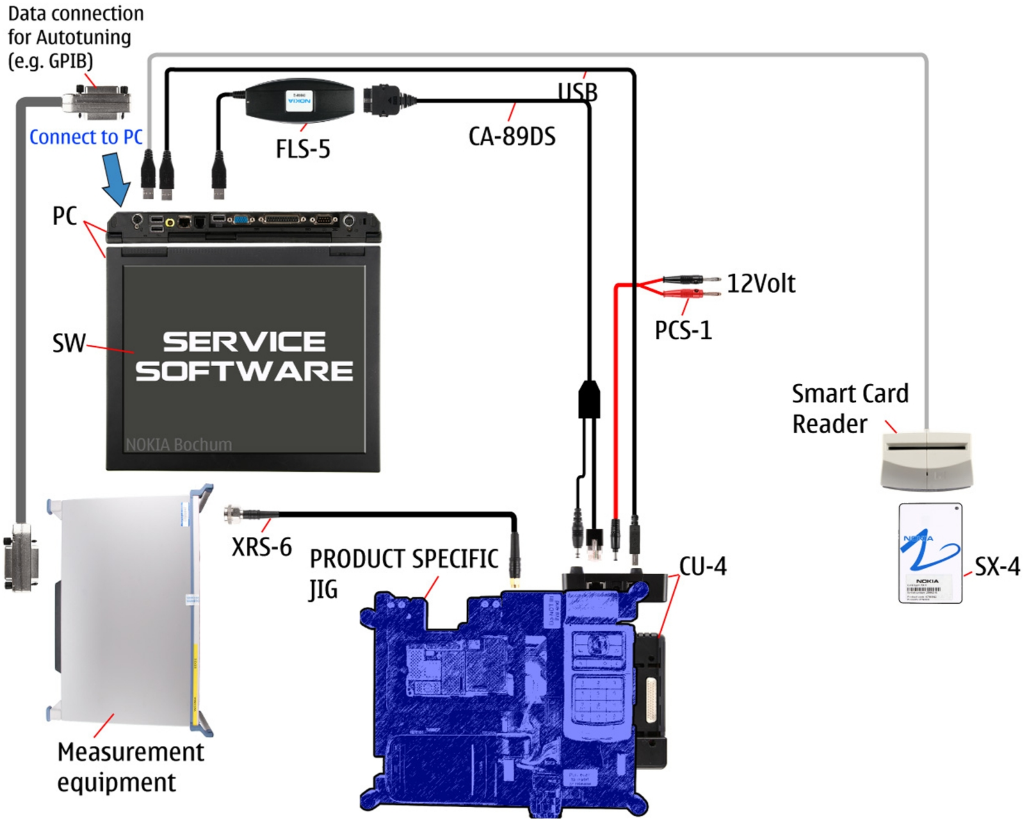

Data connection
for Autotuning
(e.g. GPIB)
Connect to PC
FLS-5
USB
CA-89DS
PC
SW
SERVICE
SOFTWARE
NOKIA Bochum
12Volt
PCS-1
Smart Card
Reader
XRS-6
PRODUCT SPECIFIC
JIG
CU-4
SX-4
Measurement
equipment

Figure 37 RF/BB tuning and flashing with FLS-5

Type	Description
Product specific tools	
MJ-93	Module jig
Other tools	
CU-4	Control unit
FLS-5	POS flash dongle
PKD-1/PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	PC with Phoenix service software

Type	Description
	Smart card reader
Cables	
CA-89DS	Cable
PCS-1	DC power cable
XRS-6	RF cable
	USB cable

Bluetooth test concept with SB-6

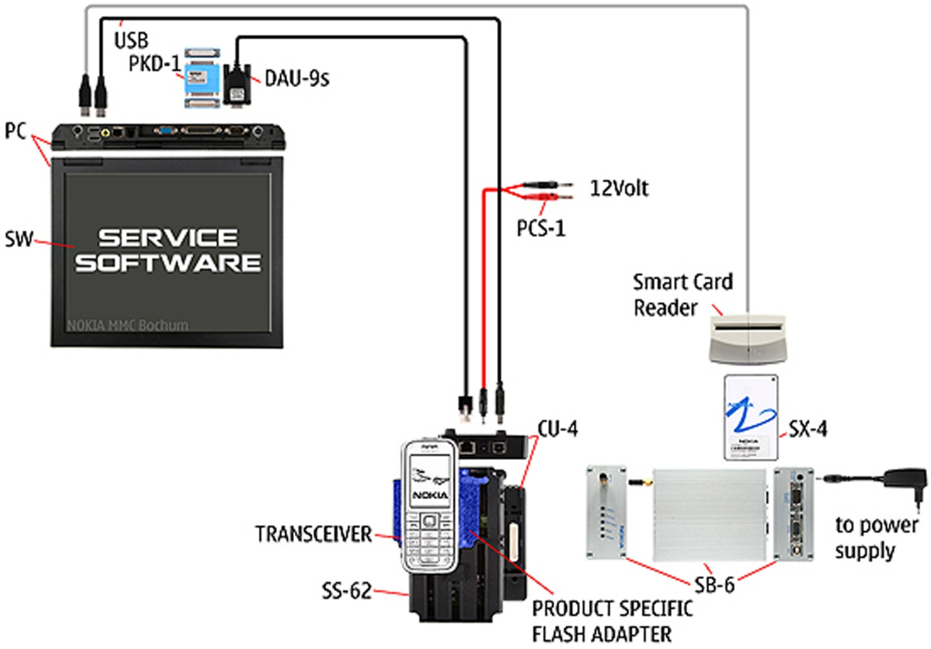

USB
PKD-1
DAU-9s
PC
SW
SERVICE SOFTWARE
NOKIA MMC Bochum
12Volt
PCS-1
Smart Card Reader
CU-4
SX-4
TRANSCEIVER
SS-62
to power supply
SB-6
PRODUCT SPECIFIC FLASH ADAPTER

Figure 38 Bluetooth test concept with SB-6

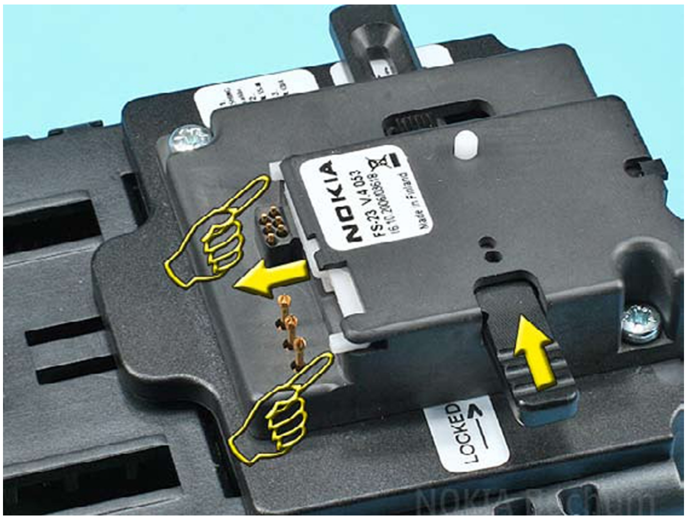
Type	Description
Product specific tools	
FS-23	Flash adapter
Other tools	
CU-4	Control unit
PKD-1	SW Security device
SS-62	Generic base adapter
SB-6	BT test box
ACP-8	Charger for SB-6
Cables	
PCS-1	Power cable
DAU-9S	Cable

Type	Description
PCS-1	DC power cable
	Standard USB cable

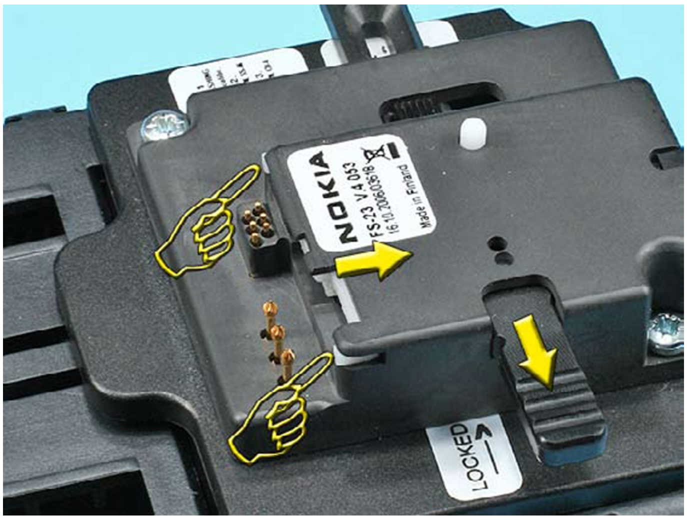
Connecting to flash adapter

Prerequisites

The picture shows the “close” position.

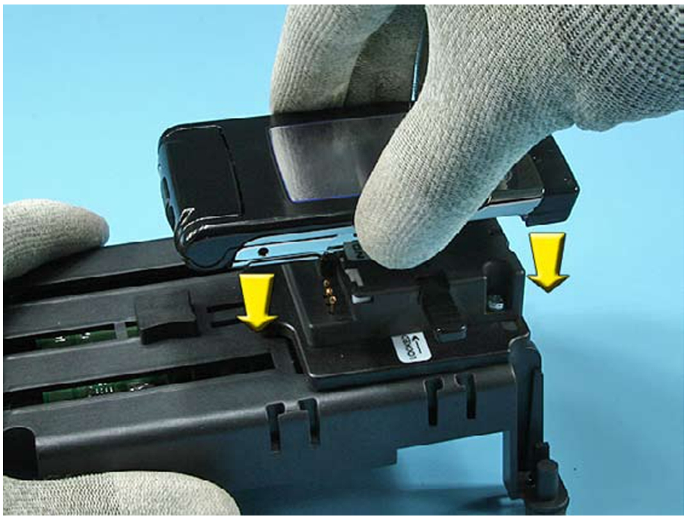

NOKIA
FS-23 V 4 053
Made in Finland
LOCKED

Before connecting the phone to the FS-23 flash adapter, make sure that the locking mechanism is open like shown in the picture.

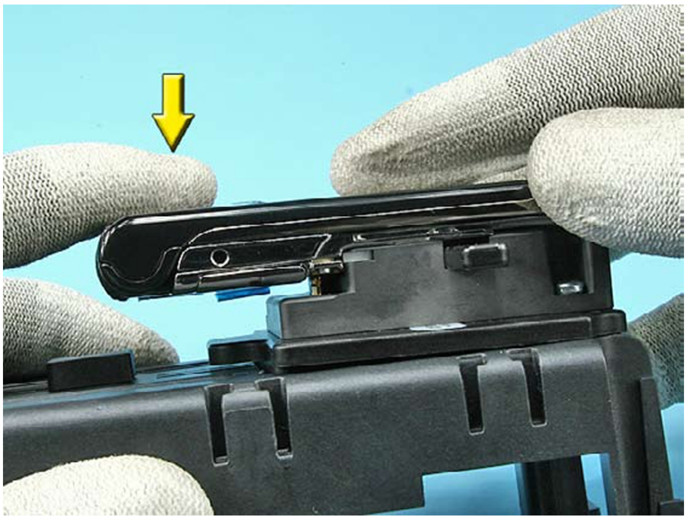

NOKIA
FS-23 V 4 053
Made in Finland
LOCKED

Steps

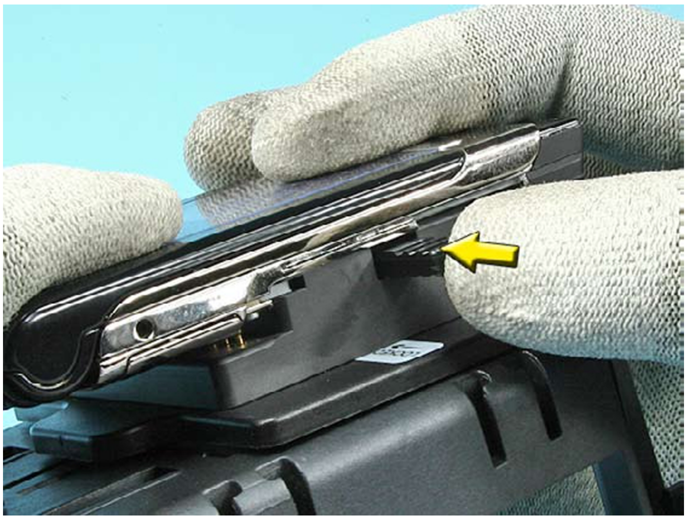
1. Start the assembly straight from the top.



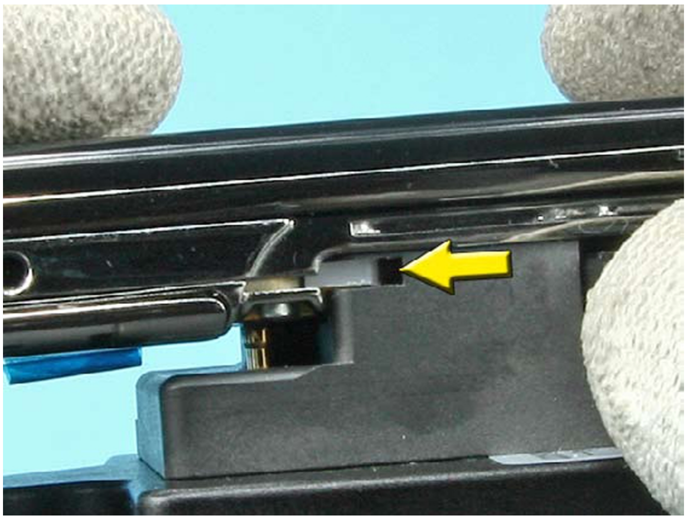
2. Press at top of the phone and hold it into position.



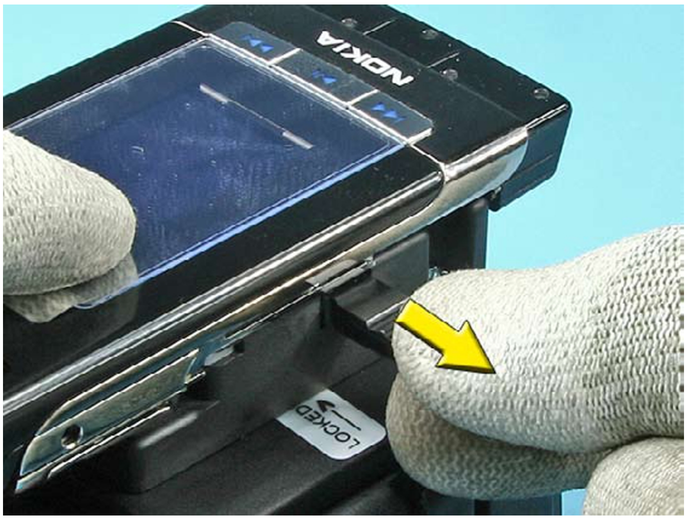
3. Close the locking mechanism while pressing the lever.



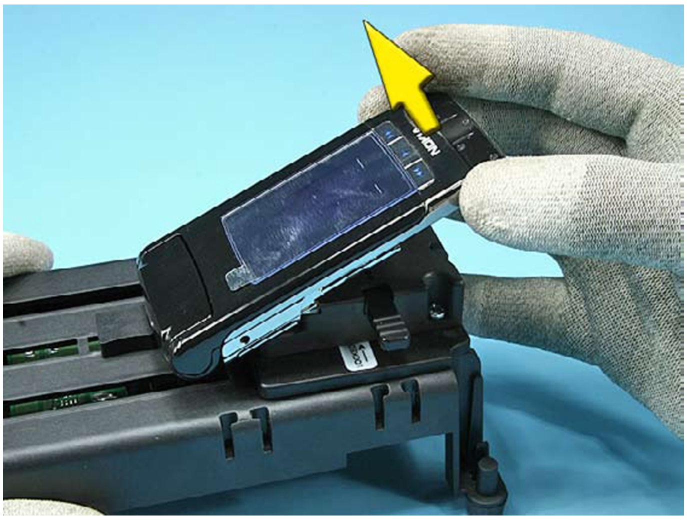
The phone is now fixed on the FS-23 flash adapter.



4. To remove the phone, pull the lever to unlock the mechanism.



5. Lift up the phone from the opposite side of the phone´s battery connector.



4 — BB Troubleshooting and Manual Tuning Guide

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Table of Contents

Troubleshooting overview 4–5
Dead or jammed device troubleshooting 4–6
General power checking 4–7
Clocking troubleshooting 4–8
Charging troubleshooting 4–9
Backup battery troubleshooting 4–10
Flash programming fault troubleshooting 4–11
Combo memory troubleshooting 4–13
MicroSD card troubleshooting 4–14
USB interface troubleshooting 4–16
SIM card troubleshooting 4–18
MR sensor troubleshooting 4–20
Keyboard troubleshooting 4–21
Power key troubleshooting 4–23
Vibra troubleshooting 4–24
Display module troubleshooting 4–25
    General instructions for display troubleshooting 4–25
    Display troubleshooting 4–26
    Backlights troubleshooting 4–27
    EL foil backlight troubleshooting 4–29
    LED driver troubleshooting 4–30
    Power LED troubleshooting 4–32
Bluetooth and FM radio 4–34
    Introduction to Bluetooth/FM Radio troubleshooting 4–34
    Bluetooth settings for Phoenix 4–35
    Bluetooth self tests in Phoenix 4–36
    Bluetooth troubleshooting 4–38
    FM radio troubleshooting 4–38
Audio troubleshooting 4–40
    Audio troubleshooting test instructions 4–40
    Internal earpiece troubleshooting 4–44
    Internal microphone troubleshooting 4–45
    IHF speakers troubleshooting 4–46
    External headset microphone troubleshooting 4–47
    External headset earpiece troubleshooting 4–48
    Acoustics troubleshooting 4–49
        Introduction to acoustics troubleshooting 4–49
        Earpiece troubleshooting 4–50
        IHF troubleshooting 4–51
        Microphone troubleshooting 4–52
Baseband manual tuning guide 4–53
    Certificate restoring for BB5 products 4–53
    Energy management calibration 4–58

List of Tables

Table 3 Display module troubleshooting cases 4–25
Table 4 Pixel defects 4–25
Table 5 Calibration value limits 4–58

List of Figures

Figure 39 Charging backup battery 4–10
Figure 40 Discharging backup battery 4–10
Figure 41 Take single trig measurement for the rise of the BSI signal. 4–12
Figure 42 USB connector 4–17
Figure 43 Bluetooth antenna 4–34
Figure 44 Bluetooth and FM radio component layout 4–35
Figure 45 BER test result 4–36
Figure 46 Bluetooth self tests in Phoenix 4–37
Figure 47 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected. 4–41
Figure 48 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected. 4–42
Figure 49 Single-ended output waveform of the Ext_in_Ext_out loop. 4–42
Figure 50 Single-ended output waveform of the HP_in_Ext_out loop. 4–43

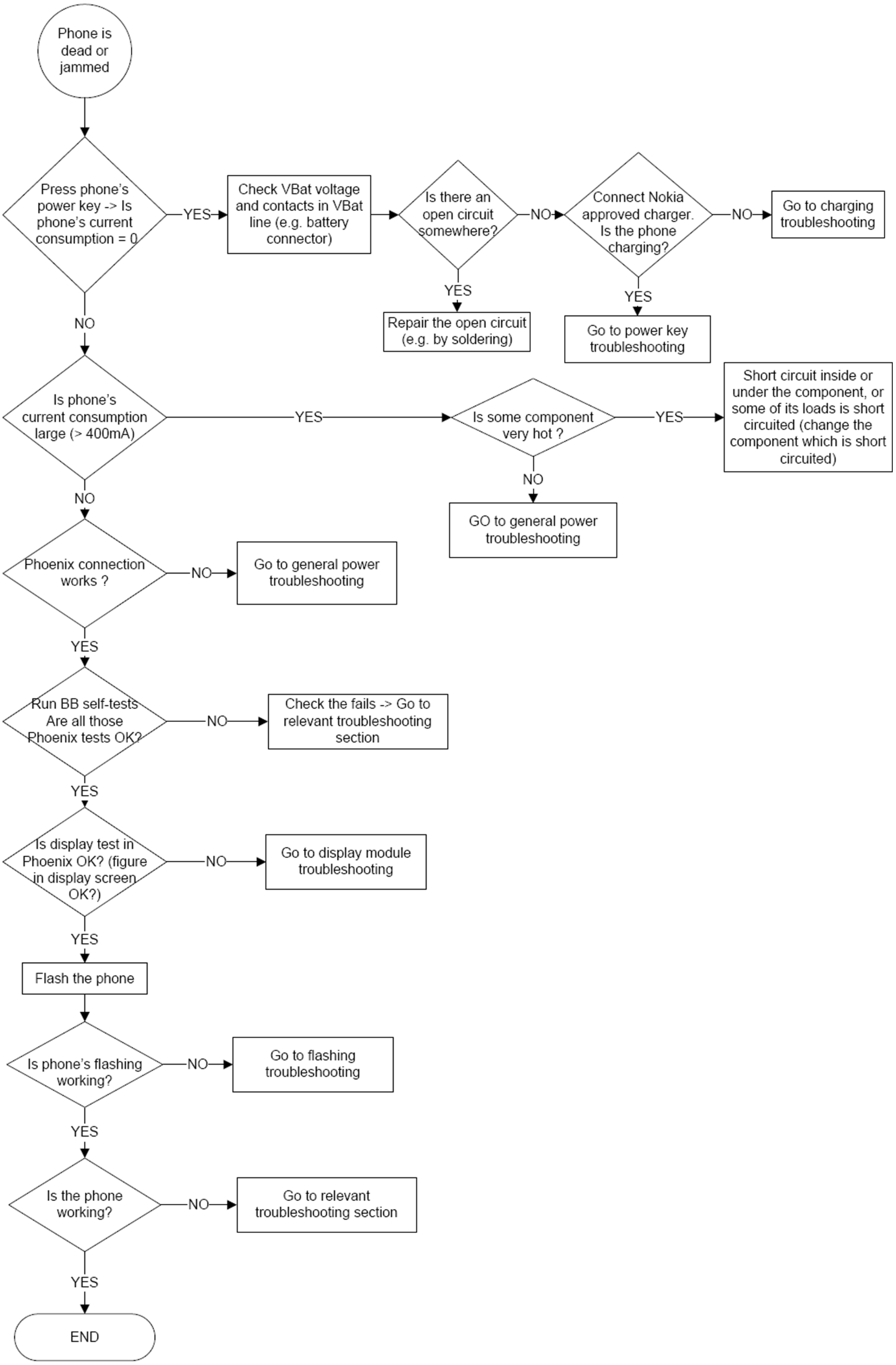
Troubleshooting overview

For practical reasons, troubleshooting is divided into two sections;

- Baseband troubleshooting, including camera, FM radio and Bluetooth.
- RF troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check VBat voltage and contacts in VBat line (e.g. battery connector)
Is there an open circuit somewhere?
NO
Connect Nokia approved charger. Is the phone charging?
NO
Go to charging troubleshooting
YES
Repair the open circuit (e.g. by soldering)
YES
Go to power key troubleshooting
NO
Is phone's current consumption large (> 400mA)
YES
Is some component very hot ?
YES
Short circuit inside or under the component, or some of its loads is short circuited (change the component which is short circuited)
NO
GO to general power troubleshooting
NO
Phoenix connection works ?
NO
Go to general power troubleshooting
YES
Run BB self-tests Are all those Phoenix tests OK?
NO
Check the fails -> Go to relevant troubleshooting section
YES
Is display test in Phoenix OK? (figure in display screen OK?)
NO
Go to display module troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to flashing troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
END

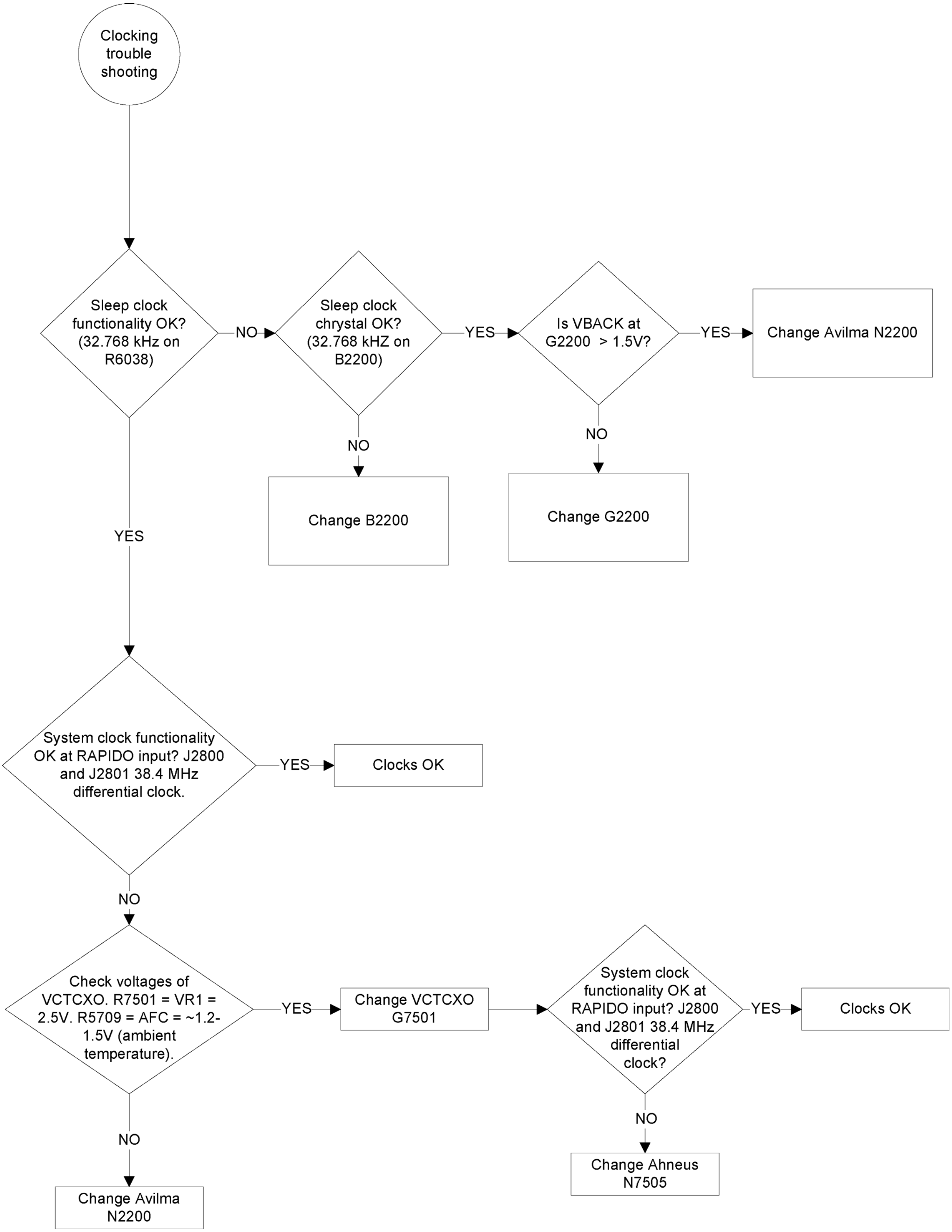
General power checking

Check the following voltages:

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
VIO	External SMPS N2201	ON	ON	1.82	Displays, I/Os		
VBACK	AVILMA	ON	ON	2.6	Back-up battery		
VSIM1							
VSIM2	AVILMA	ON	ON				VBAT3
VDRAM	External SMPS N2201	ON	ON	1.82	SDRAM		
VAUX	AVILMA	OFF	OFF	2.78	FM radio, ALS, MR sensor, displays		VBAT5
VANA	AVILMA	ON	ON	2.5	AVILMA		VBAT4
VR1	AVILMA	OFF	ON	2.5	Crystal oscillators		VBAT4
VRFC	AVILMA	ON	OFF	1.8	RAPIDO converters		
VRCP1	AVILMA			4.75	To RF parts	RF active	VBATCP
VRCP2	AVILMA			4.75			VBATCP
VREF	AVILMA	ON	ON	1.35	RF reference		
VCORE	External SMPS N2390	ON	ON	1.35/1.05 on sleep	RAPIDO digital core		
VOUT	BETTY	OFF	OFF	2.5	Audio switch		
VCAMANA	External LDO N2501			2.8	Camera		
VCAMDIG	External SMPS N2500			1.8	Camera, STV984		
LEDOUT	External SMPS N2301			< 18	Display backlight	According to Regulator spec	
VSD	SD levelshifter			2.9	MicroSD card		
VIO_VILMA	AVILMA	ON	ON	1.82	Audio, BT		

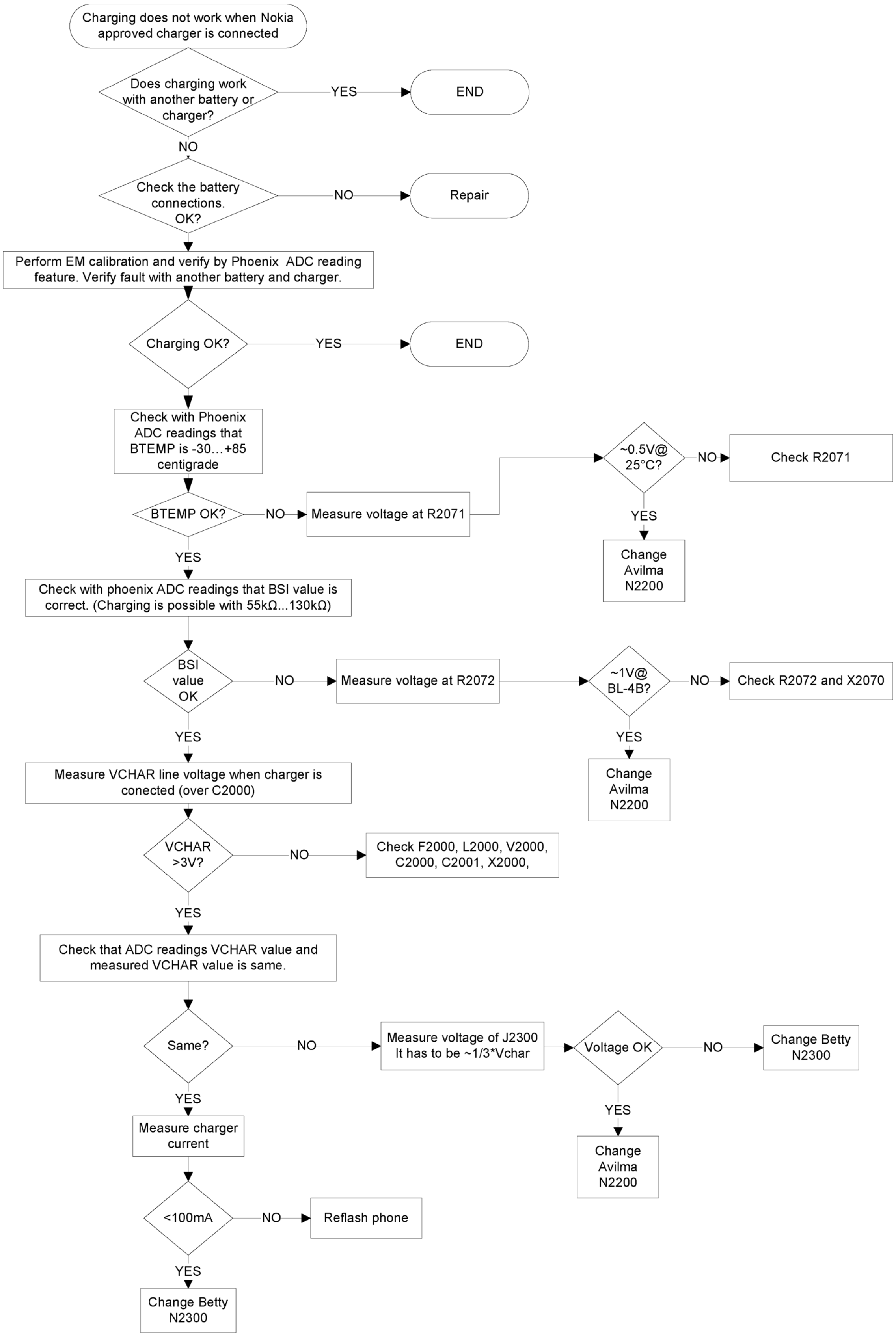
Clocking troubleshooting

Troubleshooting flow


Clocking trouble shooting
Sleep clock functionality OK? (32.768 kHz on R6038)
NO
Sleep clock chrystal OK? (32.768 kHZ on B2200)
YES
Is VBACK at G2200 > 1.5V?
YES
Change Avilma N2200
NO
Change B2200
NO
Change G2200
YES
System clock functionality OK at RAPIDO input? J2800 and J2801 38.4 MHz differential clock.
YES
Clocks OK
NO
Check voltages of VCTCXO. R7501 = VR1 = 2.5V. R5709 = AFC = ~1.2-1.5V (ambient temperature).
YES
Change VCTCXO G7501
System clock functionality OK at RAPIDO input? J2800 and J2801 38.4 MHz differential clock?
YES
Clocks OK
NO
Change Ahneus N7505
NO
Change Avilma N2200

Charging troubleshooting

Troubleshooting flow


Charging does not work when Nokia approved charger is connected
Does charging work with another battery or charger?
YES
END
NO
Check the battery connections. OK?
NO
Repair
Perform EM calibration and verify by Phoenix ADC reading feature. Verify fault with another battery and charger.
Charging OK?
YES
END
Check with Phoenix ADC readings that BTEMP is -30…+85 centigrade
BTEMP OK?
NO
Measure voltage at R2071
~0.5V@ 25°C?
NO
Check R2071
YES
Change Avilma N2200
YES
Check with phoenix ADC readings that BSI value is correct. (Charging is possible with 55kΩ...130kΩ)
BSI value OK
NO
Measure voltage at R2072
~1V@ BL-4B?
NO
Check R2072 and X2070
YES
Change Avilma N2200
YES
Measure VCHAR line voltage when charger is conected (over C2000)
VCHAR >3V?
NO
Check F2000, L2000, V2000, C2000, C2001, X2000,
YES
Check that ADC readings VCHAR value and measured VCHAR value is same.
Same?
NO
Measure voltage of J2300 It has to be ~1/3*Vchar
Voltage OK
NO
Change Betty N2300
YES
Change Avilma N2200
YES
Measure charger current
<100mA
NO
Reflash phone
YES
Change Betty N2300

Backup battery troubleshooting

Verify that the backup battery is empty (U<1V). Switch the phone on. Measure voltage of the battery when the main battery is connected to the phone and the phone is switched on.

Wait a few minutes and monitor that the backup battery voltage rises. Switch off the phone, disconnect the main battery and monitor that the voltage of the backup battery decreases. Normal behaviour of the voltage is described in the figures below.

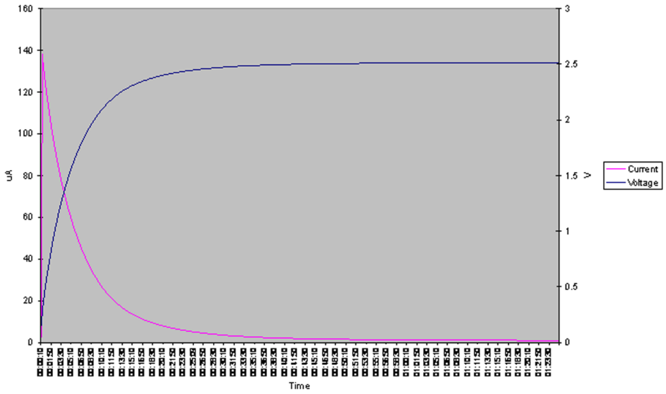


Figure 39 Charging backup battery

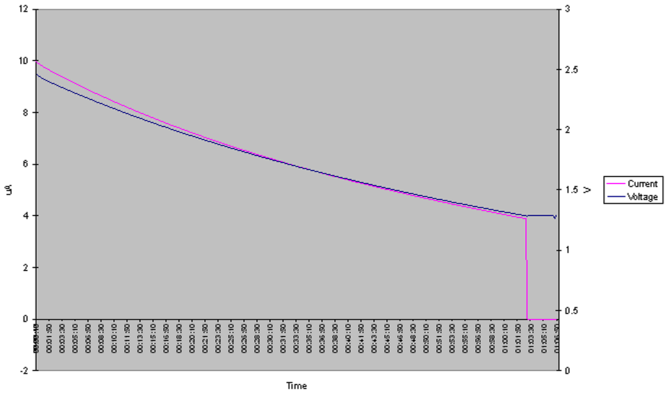
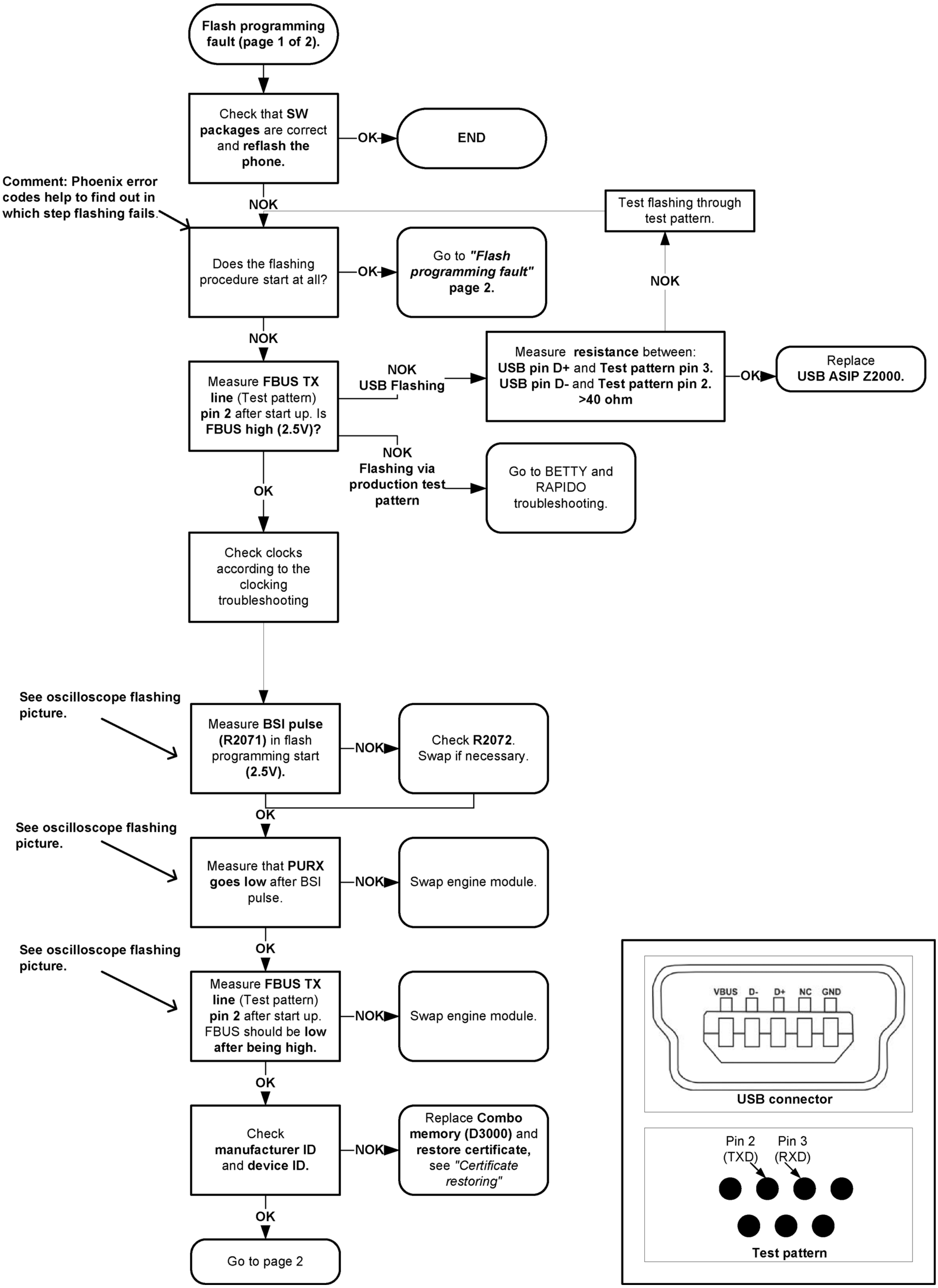


Figure 40 Discharging backup battery

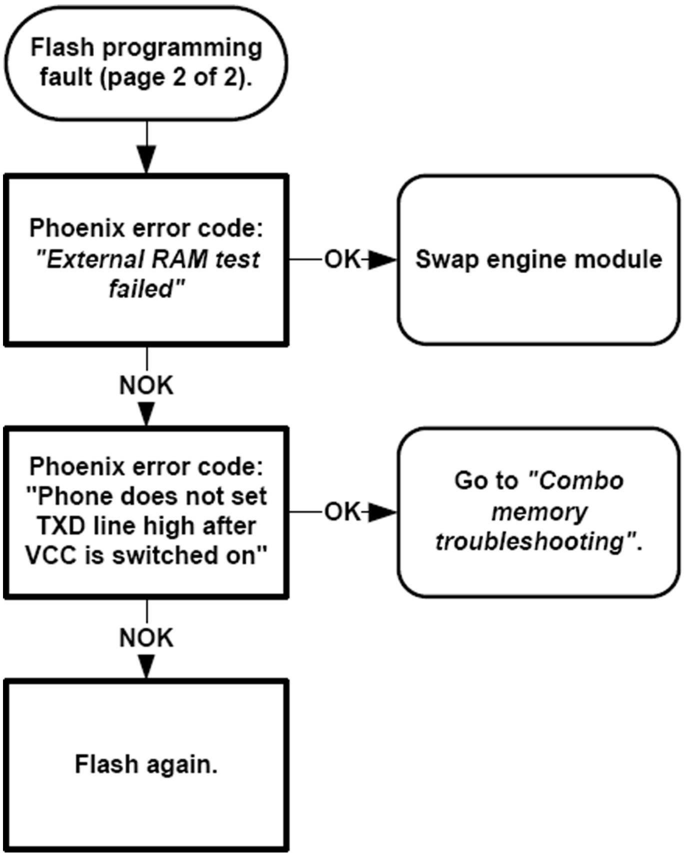
If the voltage rises and falls quickly, check whether either G2200 or C2234 is broken or short-circuited. Backup battery can be also dead. If the voltage stays ~0V, check resistance VBACK against GND. If there is no short circuit, AVILMA is faulty. Replace AVILMA.

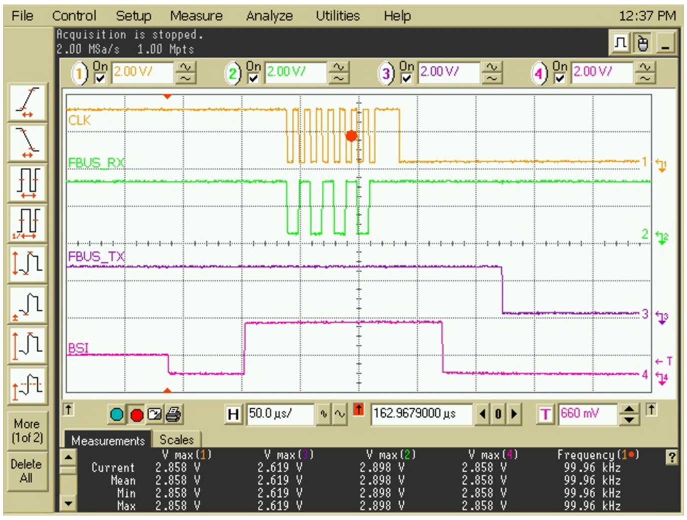
Flash programming fault troubleshooting

Part 1


Flash programming fault (page 1 of 2).
Check that SW packages are correct and reflash the phone.
OK
END
NOK
Comment: Phoenix error codes help to find out in which step flashing fails.
Test flashing through test pattern.
Does the flashing procedure start at all?
OK
Go to "Flash programming fault" page 2.
NOK
NOK
Measure FBUS TX line (Test pattern) pin 2 after start up. Is FBUS high (2.5V)?
NOK USB Flashing
Measure resistance between: USB pin D+ and Test pattern pin 3. USB pin D- and Test pattern pin 2. >40 ohm
OK
Replace USB ASIP Z2000.
NOK Flashing via production test pattern
Go to BETTY and RAPIDO troubleshooting.
OK
Check clocks according to the clocking troubleshooting
See oscilloscope flashing picture.
Measure BSI pulse (R2071) in flash programming start (2.5V).
NOK
Check R2072. Swap if necessary.
OK
See oscilloscope flashing picture.
Measure that PURX goes low after BSI pulse.
NOK
Swap engine module.
OK
See oscilloscope flashing picture.
Measure FBUS TX line (Test pattern) pin 2 after start up. FBUS should be low after being high.
NOK
Swap engine module.
OK
Check manufacturer ID and device ID.
NOK
Replace Combo memory (D3000) and restore certificate, see "Certificate restoring"
OK
Go to page 2
VBUS
D-
D+
NC
GND
USB connector
Pin 2 (TXD)
Pin 3 (RXD)
Test pattern

Part 2


Flash programming fault (page 2 of 2).
Phoenix error code: *"External RAM test failed"*
OK
Swap engine module
NOK
Phoenix error code: "Phone does not set TXD line high after VCC is switched on"
OK
Go to "*Combo memory troubleshooting*".
NOK
Flash again.


File
Control
Setup
Measure
Analyze
Utilities
Help
12:37 PM
On 2.00 V/
On 2.00 V/
On 2.00 V/
On 2.00 V/
CLK
FBUS_RX
FBUS_TX
BSI
H 50.0 µs/
162.9679000 µs
T 660 mV
More (1of 2)
Delete All
Measurements
Scales

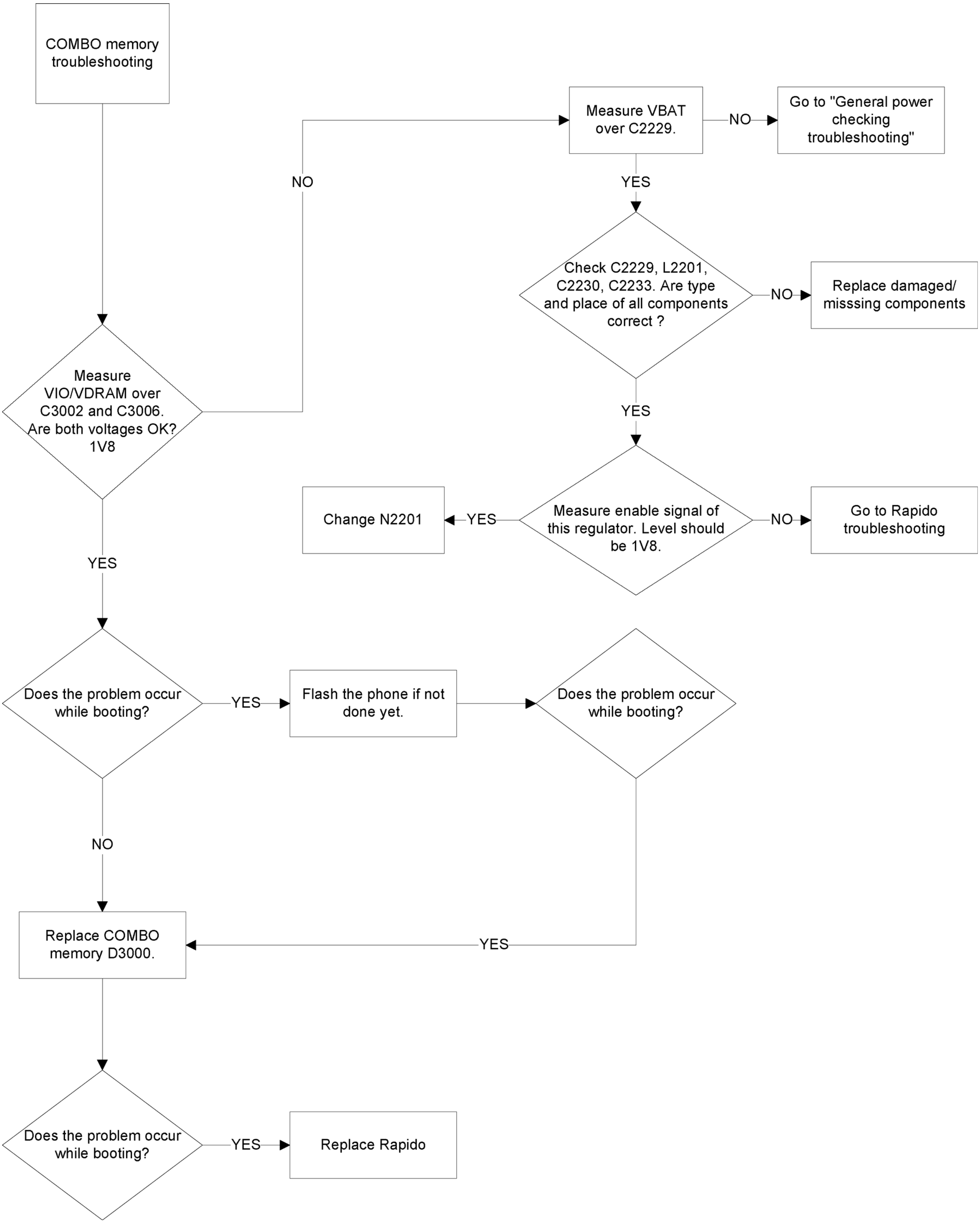
```
Acquisition is stopped.
2.00 MSa/s   1.00 Mpts
```

```
          V max(1)   V max(3)   V max(2)   V max(4)   Frequency(1)
Current   2.858 V    2.619 V    2.898 V    2.858 V     99.96 kHz
   Mean   2.858 V    2.619 V    2.898 V    2.858 V     99.96 kHz
    Min   2.858 V    2.619 V    2.898 V    2.858 V     99.96 kHz
    Max   2.858 V    2.619 V    2.898 V    2.858 V     99.96 kHz
```

Figure 41 Take single trig measurement for the rise of the BSI signal.

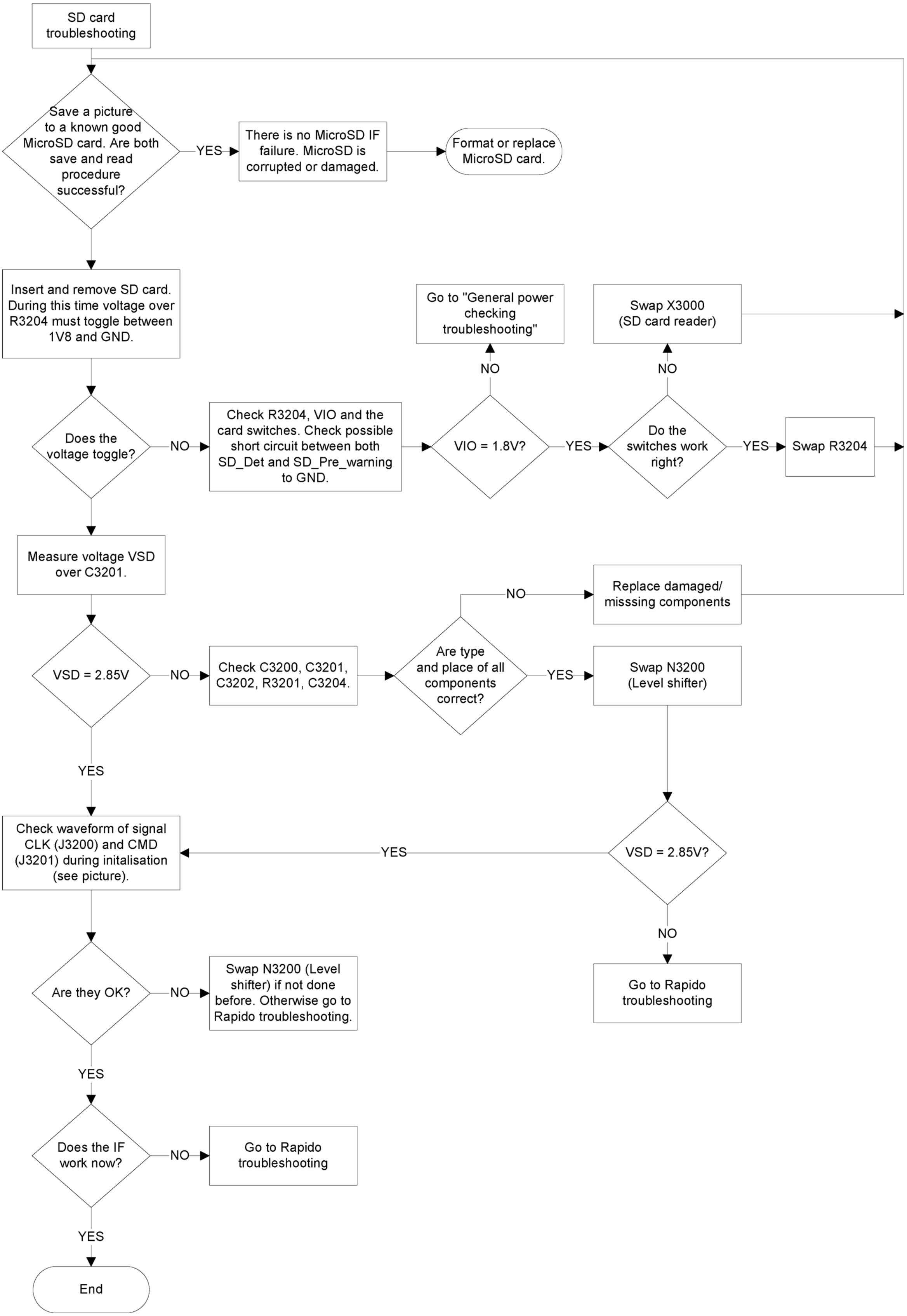
Combo memory troubleshooting

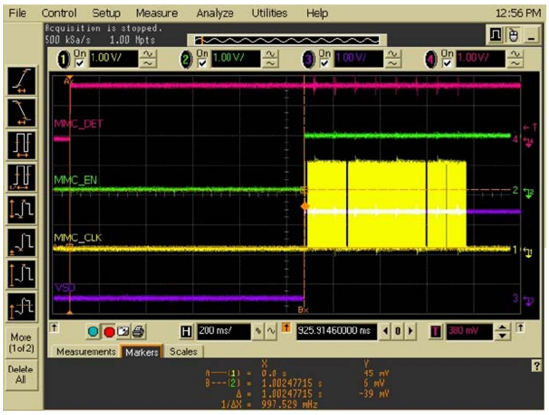
Troubleshooting flow


COMBO memory troubleshooting
Measure VIO/VDRAM over C3002 and C3006. Are both voltages OK? 1V8
NO
Measure VBAT over C2229.
NO
Go to "General power checking troubleshooting"
YES
Check C2229, L2201, C2230, C2233. Are type and place of all components correct ?
NO
Replace damaged/ misssing components
YES
Measure enable signal of this regulator. Level should be 1V8.
YES
Change N2201
NO
Go to Rapido troubleshooting
YES
Does the problem occur while booting?
YES
Flash the phone if not done yet.
Does the problem occur while booting?
NO
YES
Replace COMBO memory D3000.
Does the problem occur while booting?
YES
Replace Rapido

MicroSD card troubleshooting

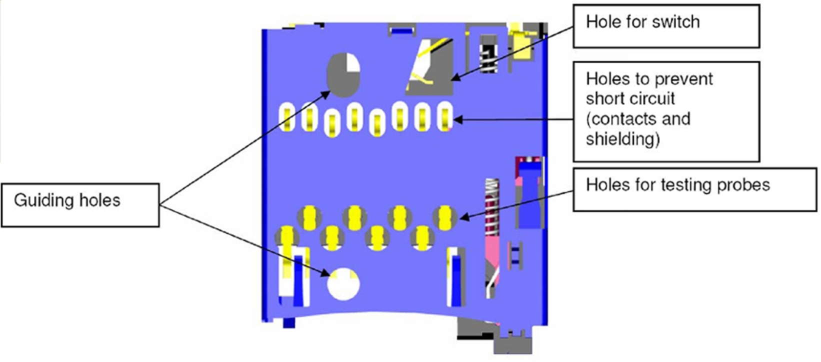
Troubleshooting flow


SD card troubleshooting
Save a picture to a known good MicroSD card. Are both save and read procedure successful?
YES
There is no MicroSD IF failure. MicroSD is corrupted or damaged.
Format or replace MicroSD card.
Insert and remove SD card. During this time voltage over R3204 must toggle between 1V8 and GND.
Go to "General power checking troubleshooting"
Swap X3000 (SD card reader)
NO
NO
Does the voltage toggle?
NO
Check R3204, VIO and the card switches. Check possible short circuit between both SD_Det and SD_Pre_warning to GND.
VIO = 1.8V?
YES
Do the switches work right?
YES
Swap R3204
Measure voltage VSD over C3201.
NO
Replace damaged/ missing components
VSD = 2.85V
NO
Check C3200, C3201, C3202, R3201, C3204.
Are type and place of all components correct?
YES
Swap N3200 (Level shifter)
YES
Check waveform of signal CLK (J3200) and CMD (J3201) during initalisation (see picture).
YES
VSD = 2.85V?
NO
Go to Rapido troubleshooting
Are they OK?
NO
Swap N3200 (Level shifter) if not done before. Otherwise go to Rapido troubleshooting.
YES
Does the IF work now?
NO
Go to Rapido troubleshooting
YES
End

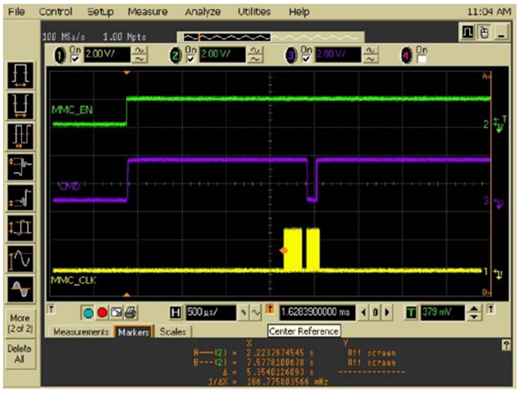

File
Control
Setup
Measure
Analyze
Utilities
Help
12:56 PM
Acquisition is stopped.
500 kSa/s 1.00 Mpts
1.00 V/
MMC_DET
MMC_EN
MMC_CLK
VSD
200 ms/
925.91460000 ms
Measurements
Markers
Scales

```
              X                 Y
A——(1) =  0.0 s               45 mV
B---(2) = 1.00247715 s         6 mV
      Δ = 1.00247715 s       -39 mV
  1/ΔX =  997.529 mHz
```

MicroSD interface signals timing when door is closed.

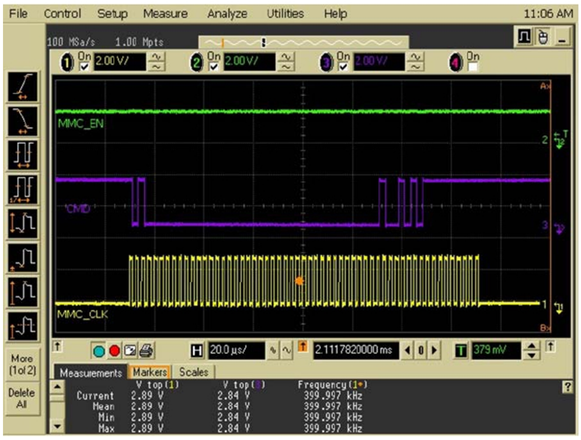

Hole for switch
Holes to prevent short circuit (contacts and shielding)
Guiding holes
Holes for testing probes

MicroSD connector


File
Control
Setup
Measure
Analyze
Utilities
Help
11:04 AM
100 MSa/s 1.00 Mpts
2.00 V/
MMC_EN
CMD
MMC_CLK
500 µs/
1.6283900000 ms
379 mV
Measurements
Markers
Scales
Center Reference

```
              X                    Y
A——(2) =  2.2237974545 s       Off screen
B---(2) = 7.5778100638 s       Off screen
      Δ = 5.3540126093 s      --------------
  1/ΔX =  186.775803566 mHz
```

CLK and CMD signals during card initiaisation when card is not inserted. Measured from the microSD connector.

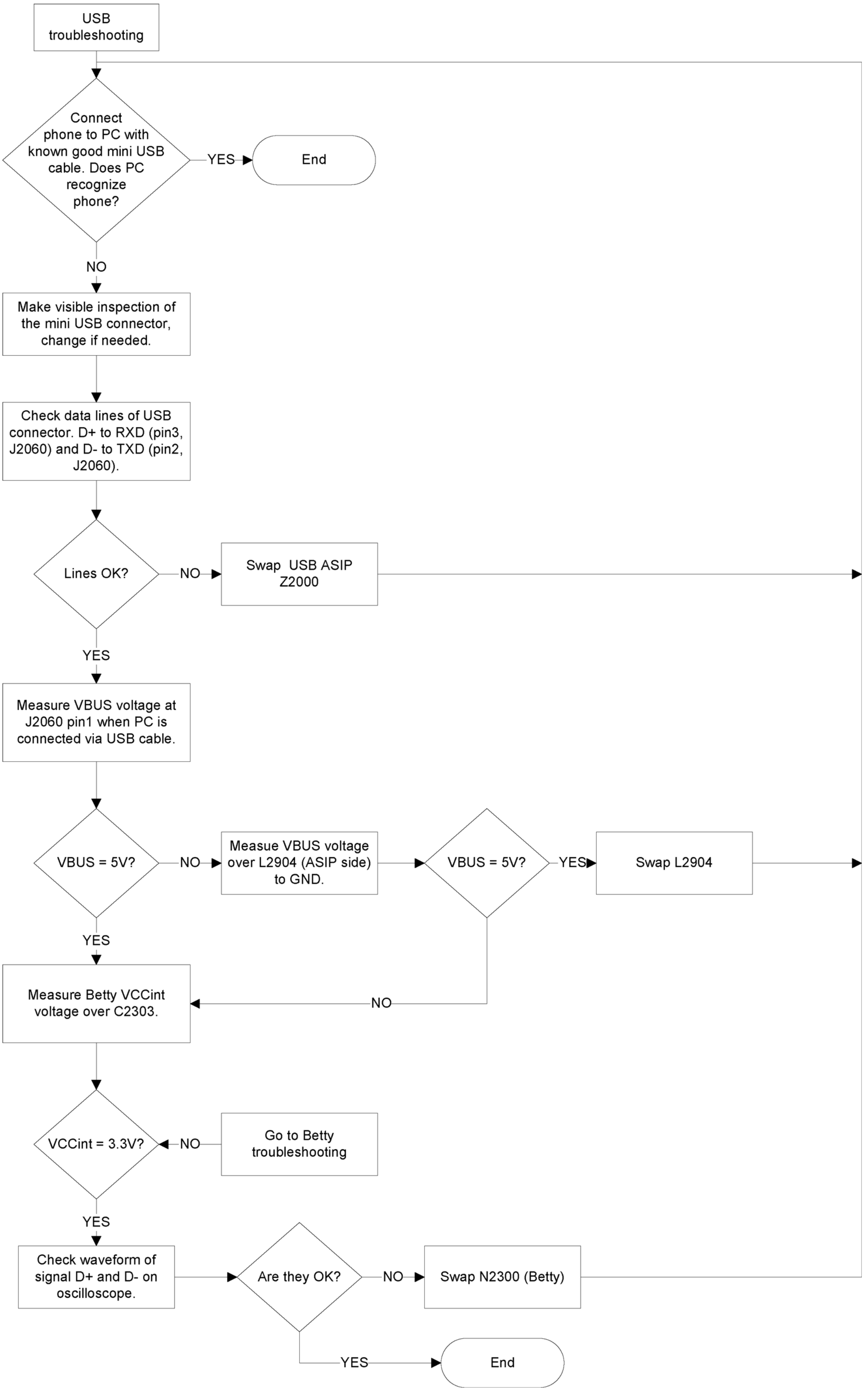

File
Control
Setup
Measure
Analyze
Utilities
Help
11:06 AM
100 MSa/s 1.00 Mpts
2.00 V/
MMC_EN
CMD
MMC_CLK
20.0 µs/
2.1117820000 ms
379 mV
Measurements
Markers
Scales

```
          V top(1)       V top(3)      Frequency(1↑)
Current   2.89 V         2.84 V        399.997 kHz
   Mean   2.89 V         2.84 V        399.997 kHz
    Min   2.89 V         2.84 V        399.997 kHz
    Max   2.89 V         2.84 V        399.997 kHz
```

CLK and CMD signals during card initiaisation when card is not inserted. Measured from the microSD connector

USB interface troubleshooting

Troubleshooting flow


USB troubleshooting
Connect phone to PC with known good mini USB cable. Does PC recognize phone?
YES
End
NO
Make visible inspection of the mini USB connector, change if needed.
Check data lines of USB connector. D+ to RXD (pin3, J2060) and D- to TXD (pin2, J2060).
Lines OK?
NO
Swap USB ASIP Z2000
YES
Measure VBUS voltage at J2060 pin1 when PC is connected via USB cable.
VBUS = 5V?
NO
Measure VBUS voltage over L2904 (ASIP side) to GND.
VBUS = 5V?
YES
Swap L2904
YES
Measure Betty VCCint voltage over C2303.
NO
VCCint = 3.3V?
NO
Go to Betty troubleshooting
YES
Check waveform of signal D+ and D- on oscilloscope.
Are they OK?
NO
Swap N2300 (Betty)
YES
End

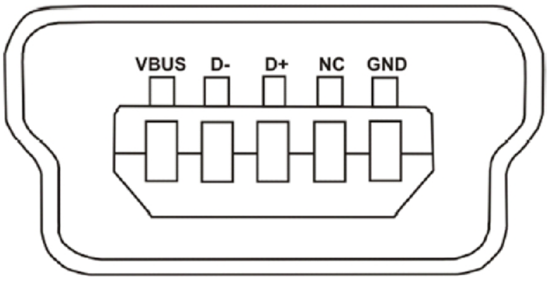
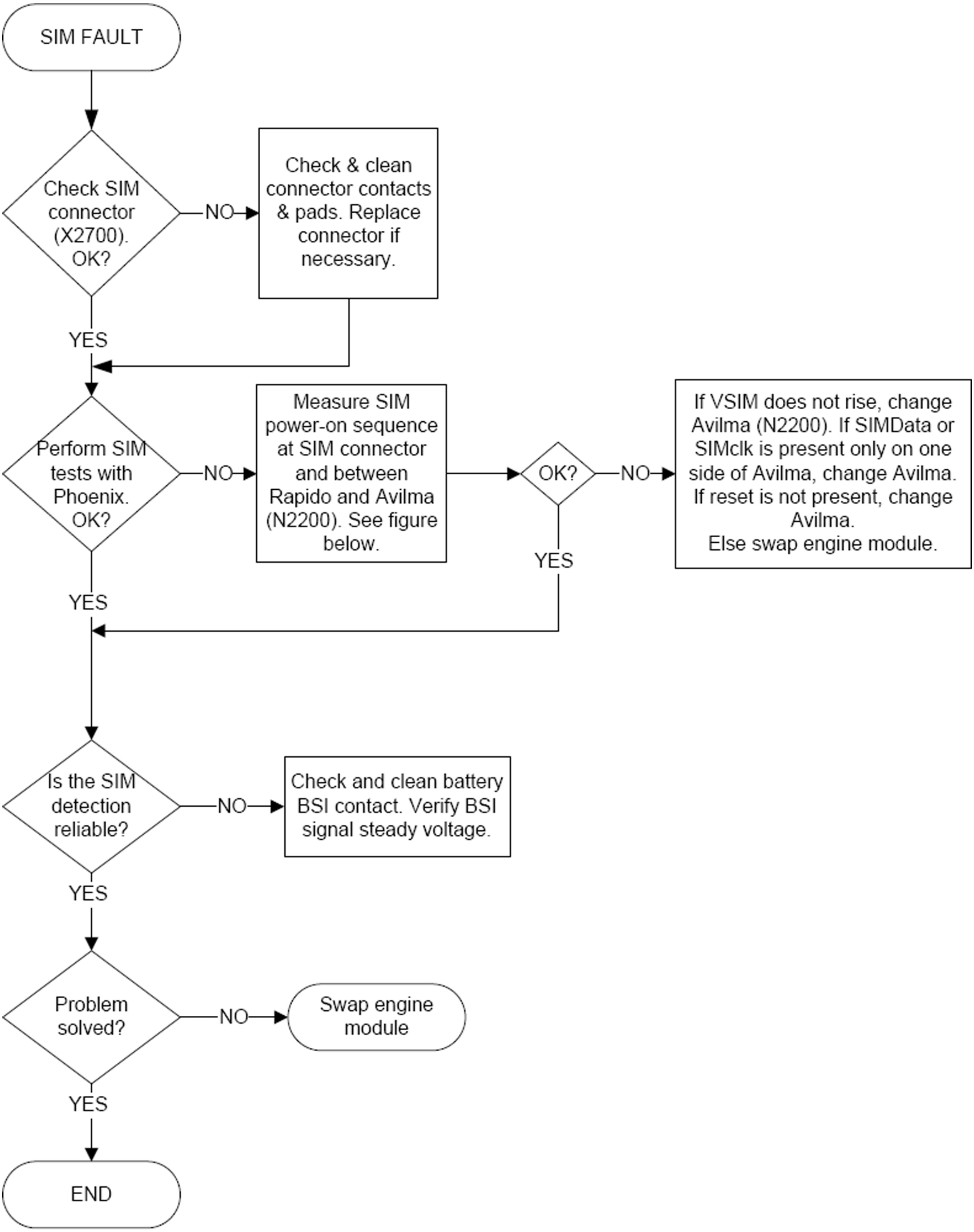


Figure 42 USB connector

SIM card troubleshooting

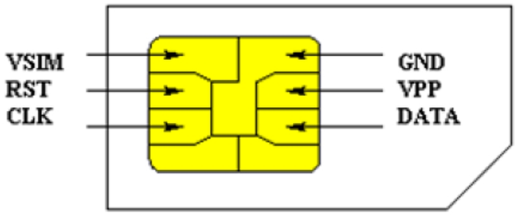
Troubleshooting flow


SIM FAULT
Check SIM connector (X2700). OK?
NO
Check & clean connector contacts & pads. Replace connector if necessary.
YES
Perform SIM tests with Phoenix. OK?
NO
Measure SIM power-on sequence at SIM connector and between Rapido and Avilma (N2200). See figure below.
OK?
NO
If VSIM does not rise, change Avilma (N2200). If SIMData or SIMclk is present only on one side of Avilma, change Avilma. If reset is not present, change Avilma.
Else swap engine module.
YES
YES
Is the SIM detection reliable?
NO
Check and clean battery BSI contact. Verify BSI signal steady voltage.
YES
Problem solved?
NO
Swap engine module
YES
END

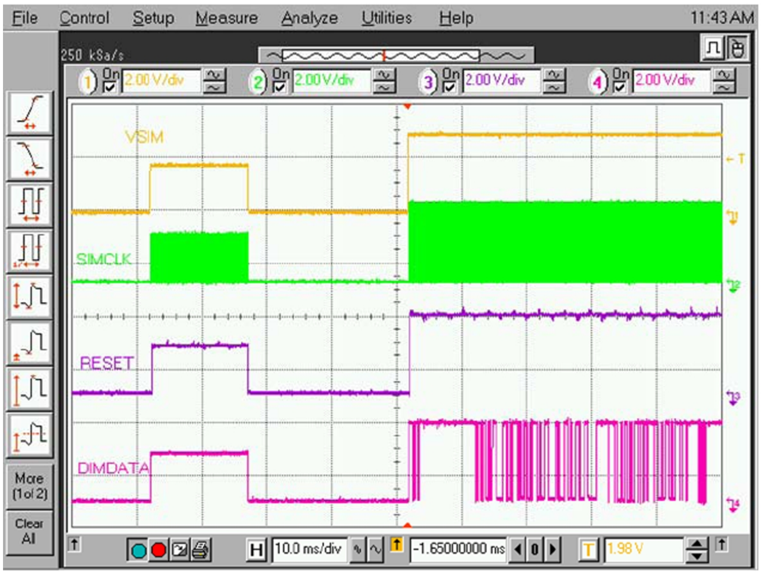
SIM power-on sequence

Testpoints between
Rapido and AVILMA
J2213 = SIMCLK
J2214 = SIMDATA
J2215 = SIMIOC

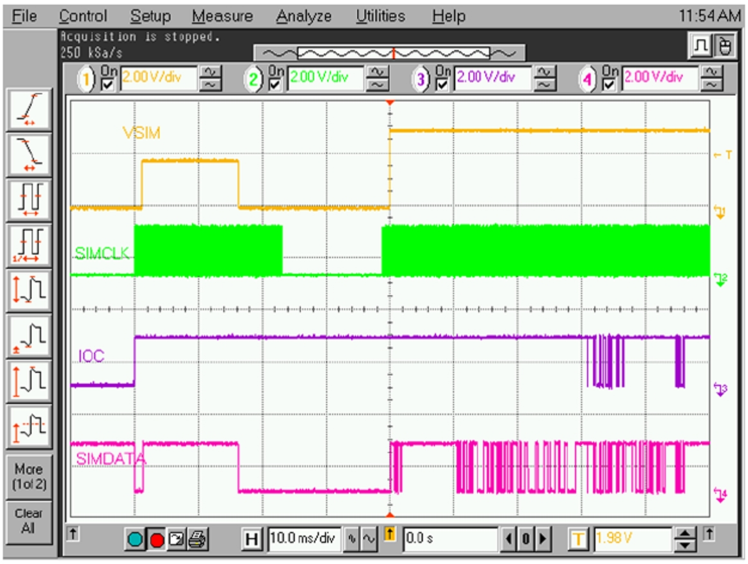
Fsimclk = 3.2MHz


VSIM
RST
CLK
GND
VPP
DATA

SIM contacts


File
Control
Setup
Measure
Analyze
Utilities
Help
11:43 AM
250 kSa/s
1 On 2.00 V/div
2 On 2.00 V/div
3 On 2.00 V/div
4 On 2.00 V/div
VSIM
SIMCLK
RESET
DIMDATA
More (1 of 2)
Clear All
H 10.0 ms/div
-1.65000000 ms
T 1.98 V

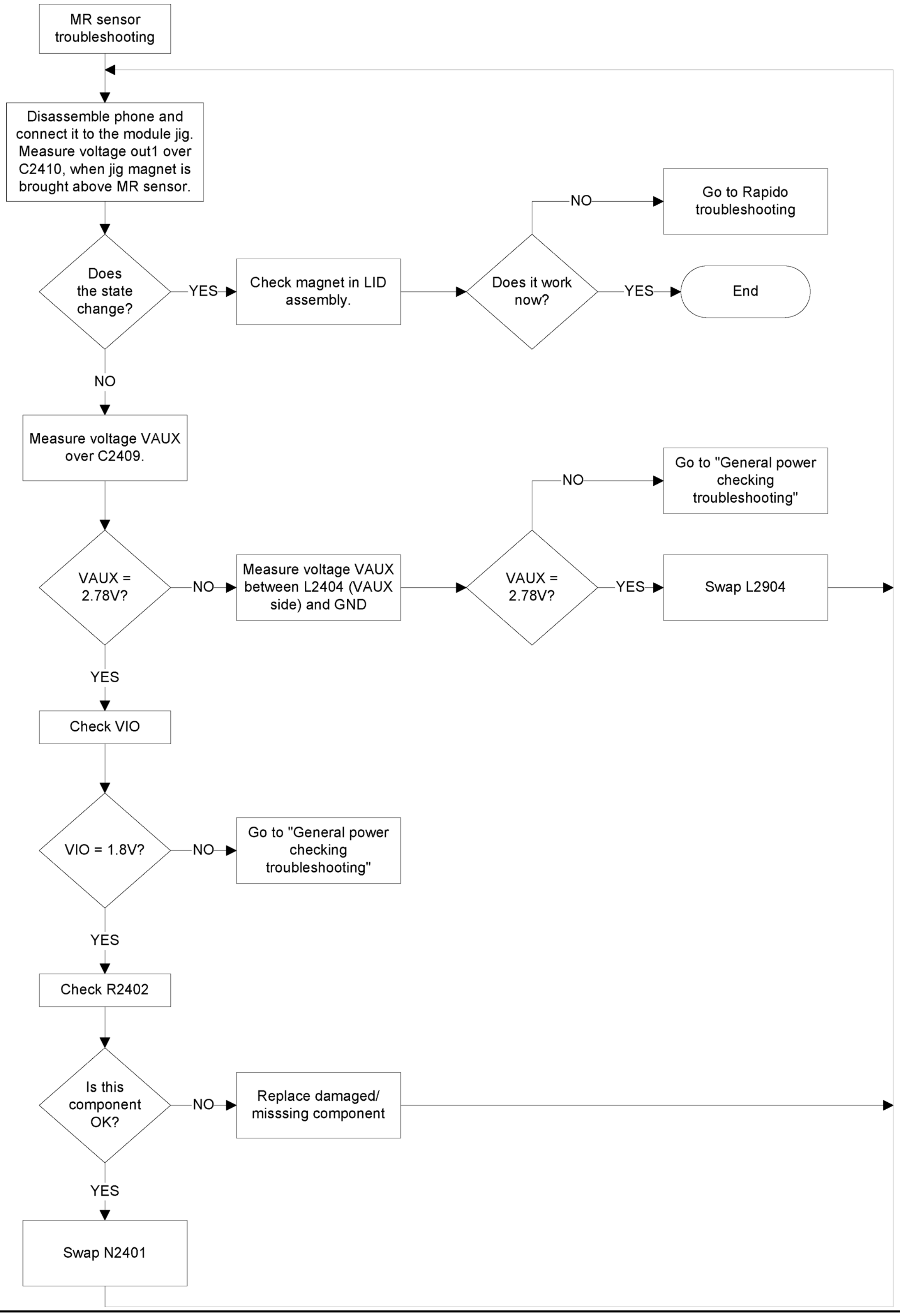
SIM power-on sequence on X2700.


File
Control
Setup
Measure
Analyze
Utilities
Help
11:54 AM
Acquisition is stopped.
250 kSa/s
1 On 2.00 V/div
2 On 2.00 V/div
3 On 2.00 V/div
4 On 2.00 V/div
VSIM
SIMCLK
IOC
SIMDATA
More (1 of 2)
Clear All
H 10.0 ms/div
0.0 s
T 1.98 V

SIM power-on sequence between Rapido and Avilma.

MR sensor troubleshooting

Troubleshooting flow


MR sensor troubleshooting
Disassemble phone and connect it to the module jig. Measure voltage out1 over C2410, when jig magnet is brought above MR sensor.
Does the state change?
YES
Check magnet in LID assembly.
Does it work now?
NO
Go to Rapido troubleshooting
YES
End
NO
Measure voltage VAUX over C2409.
VAUX = 2.78V?
NO
Measure voltage VAUX between L2404 (VAUX side) and GND
VAUX = 2.78V?
NO
Go to "General power checking troubleshooting"
YES
Swap L2904
YES
Check VIO
VIO = 1.8V?
NO
Go to "General power checking troubleshooting"
YES
Check R2402
Is this component OK?
NO
Replace damaged/ missing component
YES
Swap N2401

Keyboard troubleshooting

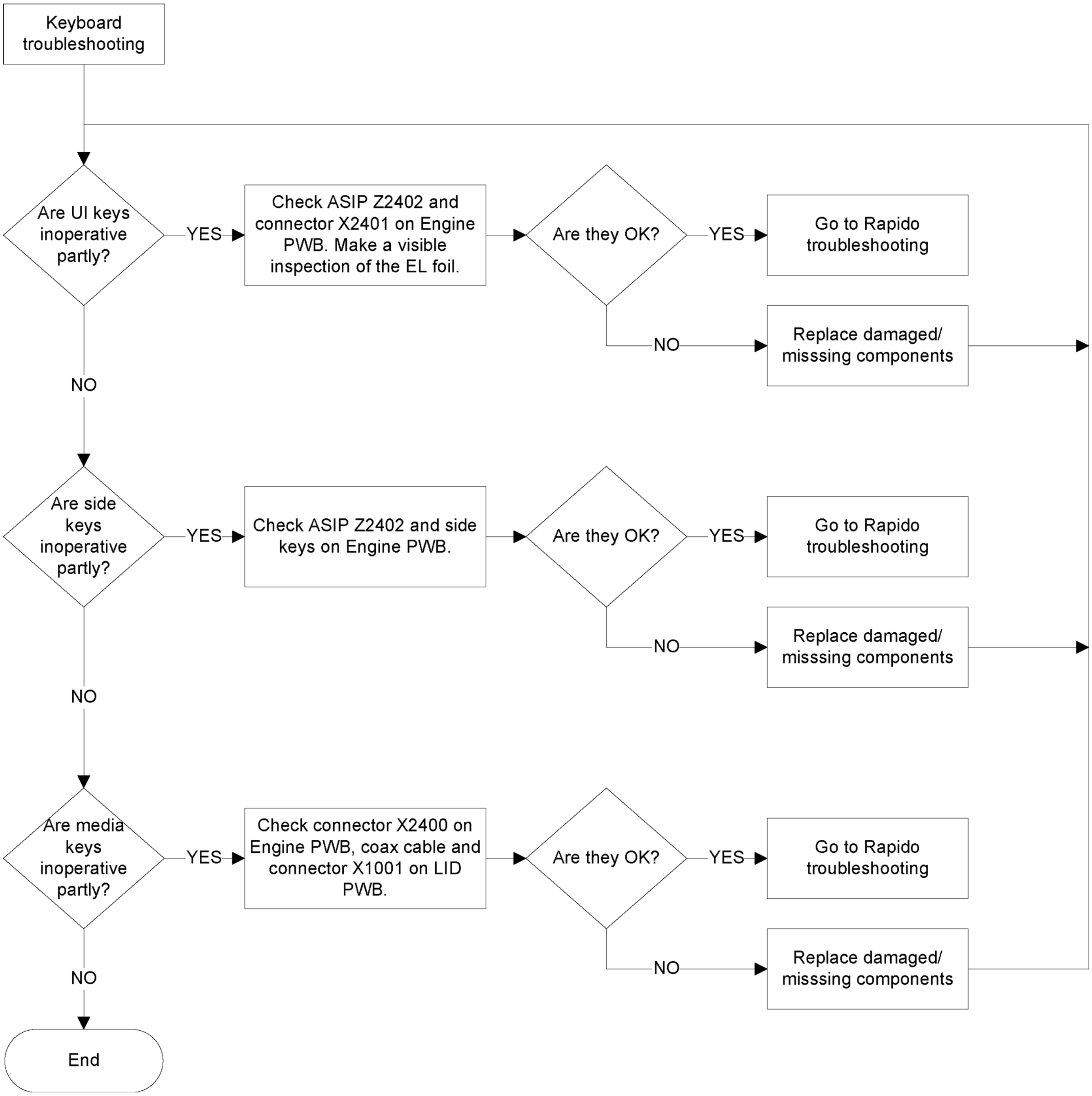
Context

There are two possible failure modes in the keyboard module:

- One or more keys can be stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust).
- Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcut or open connection). For a more detailed description of the keyboard and keymatrix, see section Keyboard.

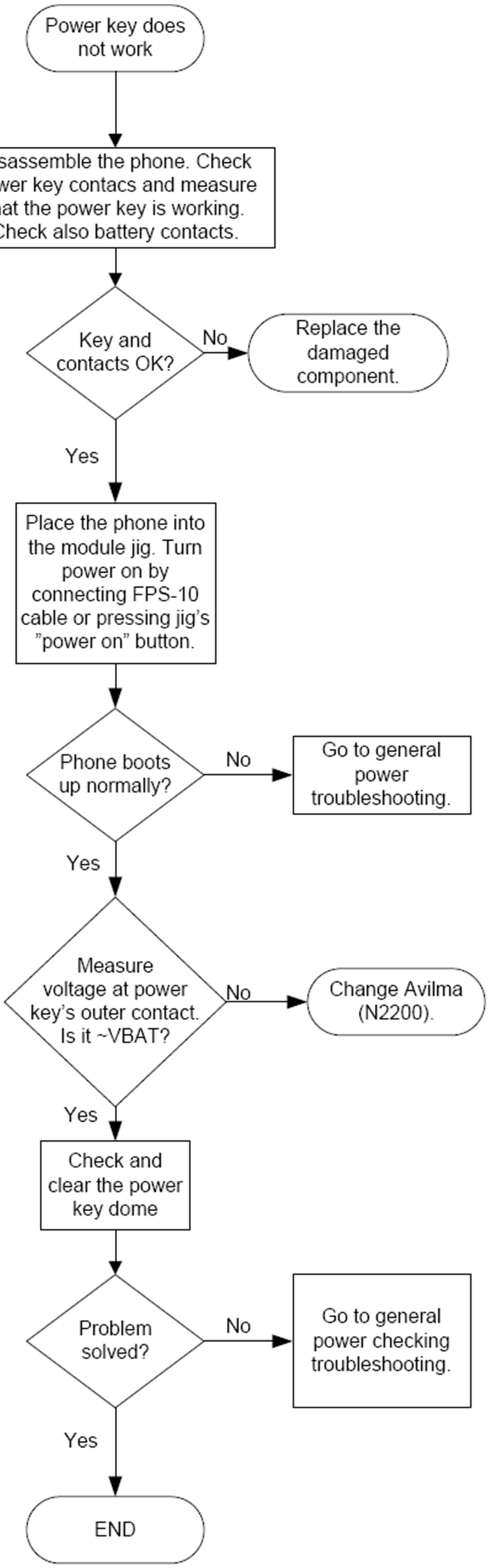
If the failure mode is not clear, start with the Keyboard Test in Phoenix.

Troubleshooting flow


Keyboard troubleshooting
Are UI keys inoperative partly?
YES
Check ASIP Z2402 and connector X2401 on Engine PWB. Make a visible inspection of the EL foil.
Are they OK?
YES
Go to Rapido troubleshooting
NO
Replace damaged/ misssing components
NO
Are side keys inoperative partly?
YES
Check ASIP Z2402 and side keys on Engine PWB.
Are they OK?
YES
Go to Rapido troubleshooting
NO
Replace damaged/ misssing components
NO
Are media keys inoperative partly?
YES
Check connector X2400 on Engine PWB, coax cable and connector X1001 on LID PWB.
Are they OK?
YES
Go to Rapido troubleshooting
NO
Replace damaged/ misssing components
NO
End

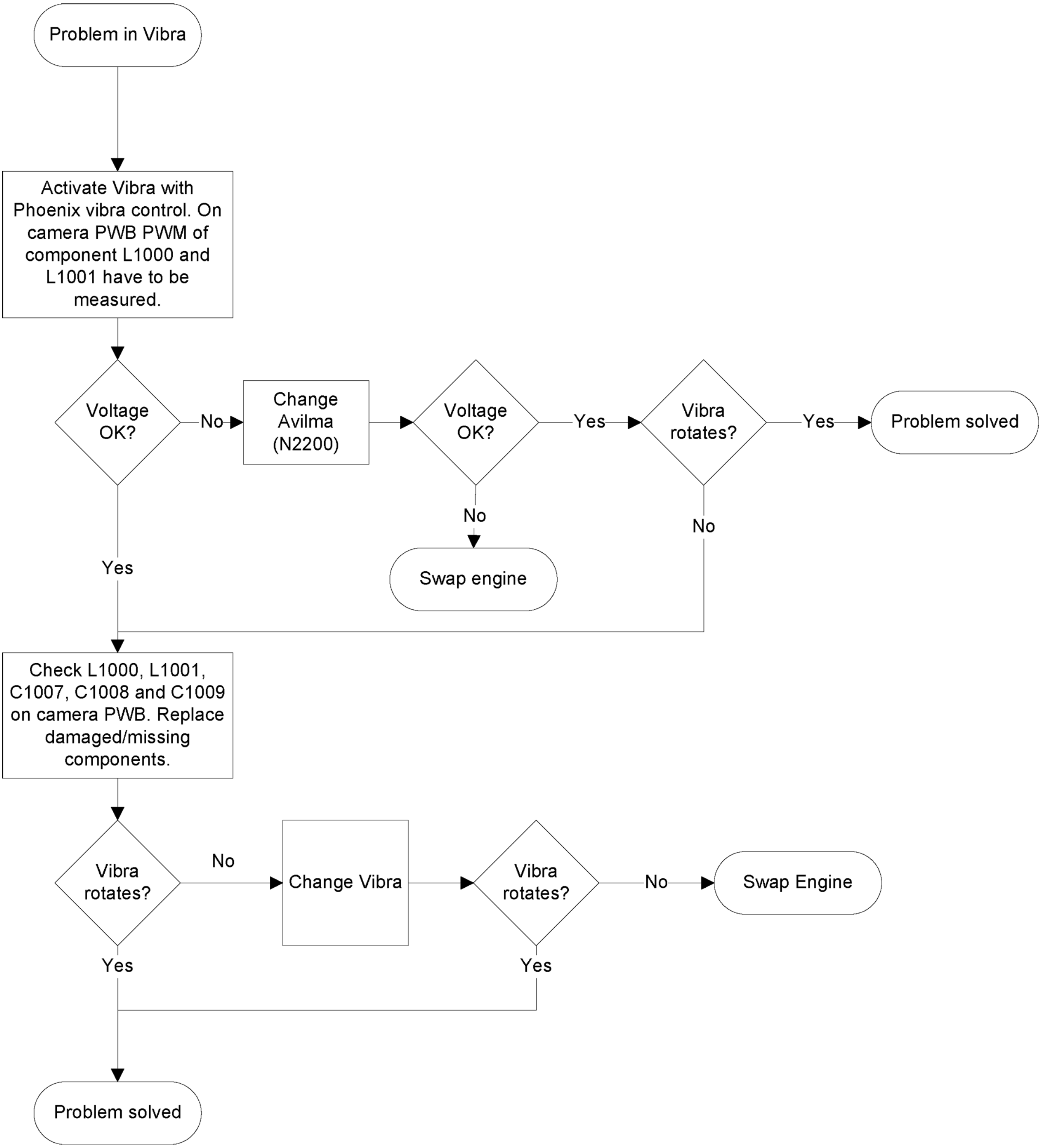
Power key troubleshooting

Troubleshooting flow


Power key does not work
Disassemble the phone. Check power key contacs and measure that the power key is working. Check also battery contacts.
Key and contacts OK?
No
Replace the damaged component.
Yes
Place the phone into the module jig. Turn power on by connecting FPS-10 cable or pressing jig's "power on" button.
Phone boots up normally?
No
Go to general power troubleshooting.
Yes
Measure voltage at power key's outer contact. Is it ~VBAT?
No
Change Avilma (N2200).
Yes
Check and clear the power key dome
Problem solved?
No
Go to general power checking troubleshooting.
Yes
END

Vibra troubleshooting

Troubleshooting flow


Problem in Vibra
Activate Vibra with Phoenix vibra control. On camera PWB PWM of component L1000 and L1001 have to be measured.
Voltage OK?
No
Change Avilma (N2200)
Voltage OK?
Yes
Vibra rotates?
Yes
Problem solved
No
Swap engine
No
Yes
Check L1000, L1001, C1007, C1008 and C1009 on camera PWB. Replace damaged/missing components.
Vibra rotates?
No
Change Vibra
Vibra rotates?
No
Swap Engine
Yes
Yes
Problem solved

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Displays are off when the phone is in the screen saver mode. Then power LED is active.
- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 3 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 4 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Steps

1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.
2. Check that the cellular engine is working normally.
   - i To check the functionality, connect the phone to a docking station.
   - ii Start *Phoenix* service software.
   - iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).
3. Proceed to the display troubleshooting flowcharts.

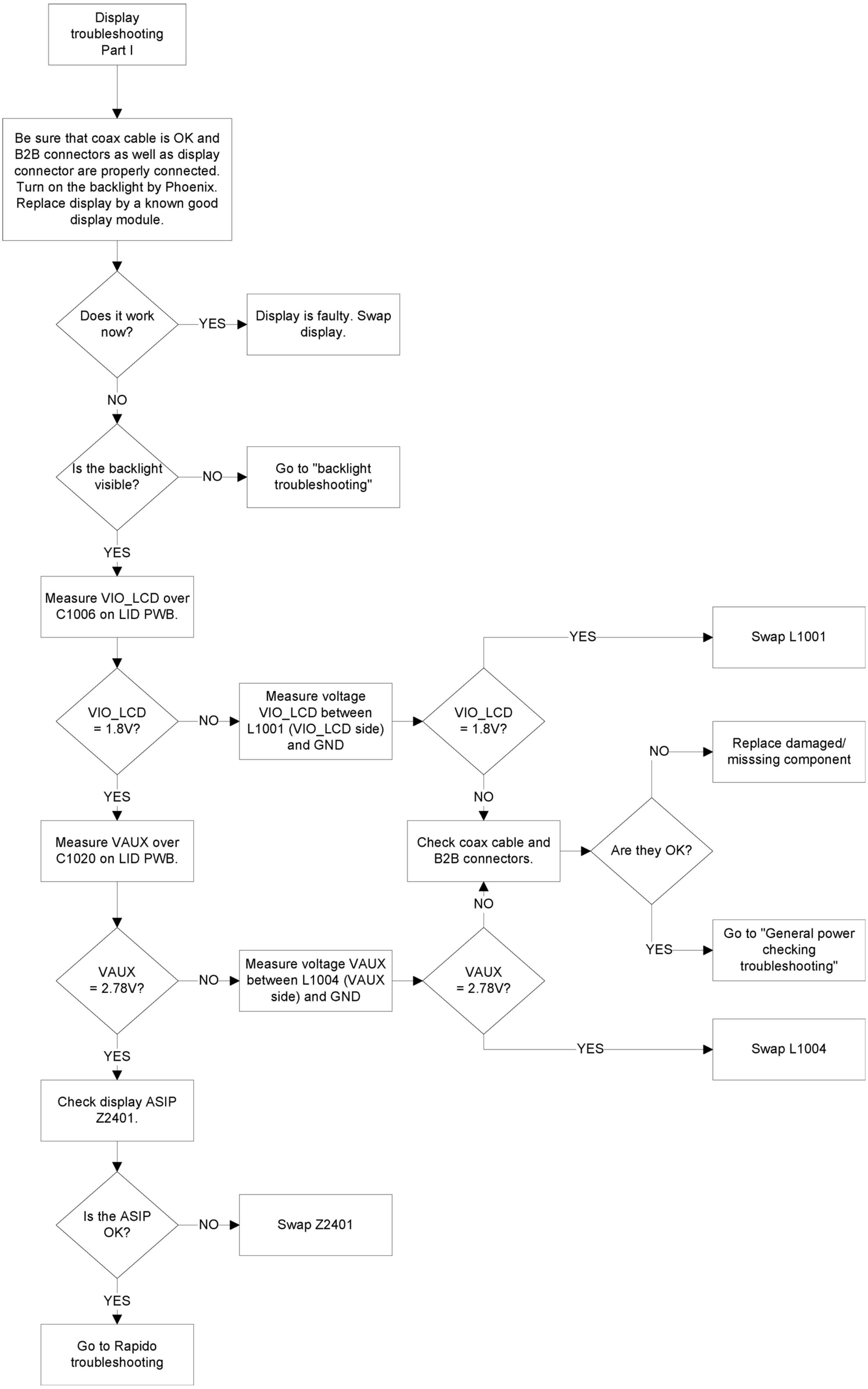
   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display troubleshooting

Context

Before going to display troubleshooting flow, make sure that the engine is working and starting up correctly. If the problem is in the engine, go to baseband troubleshooting.

Troubleshooting flow

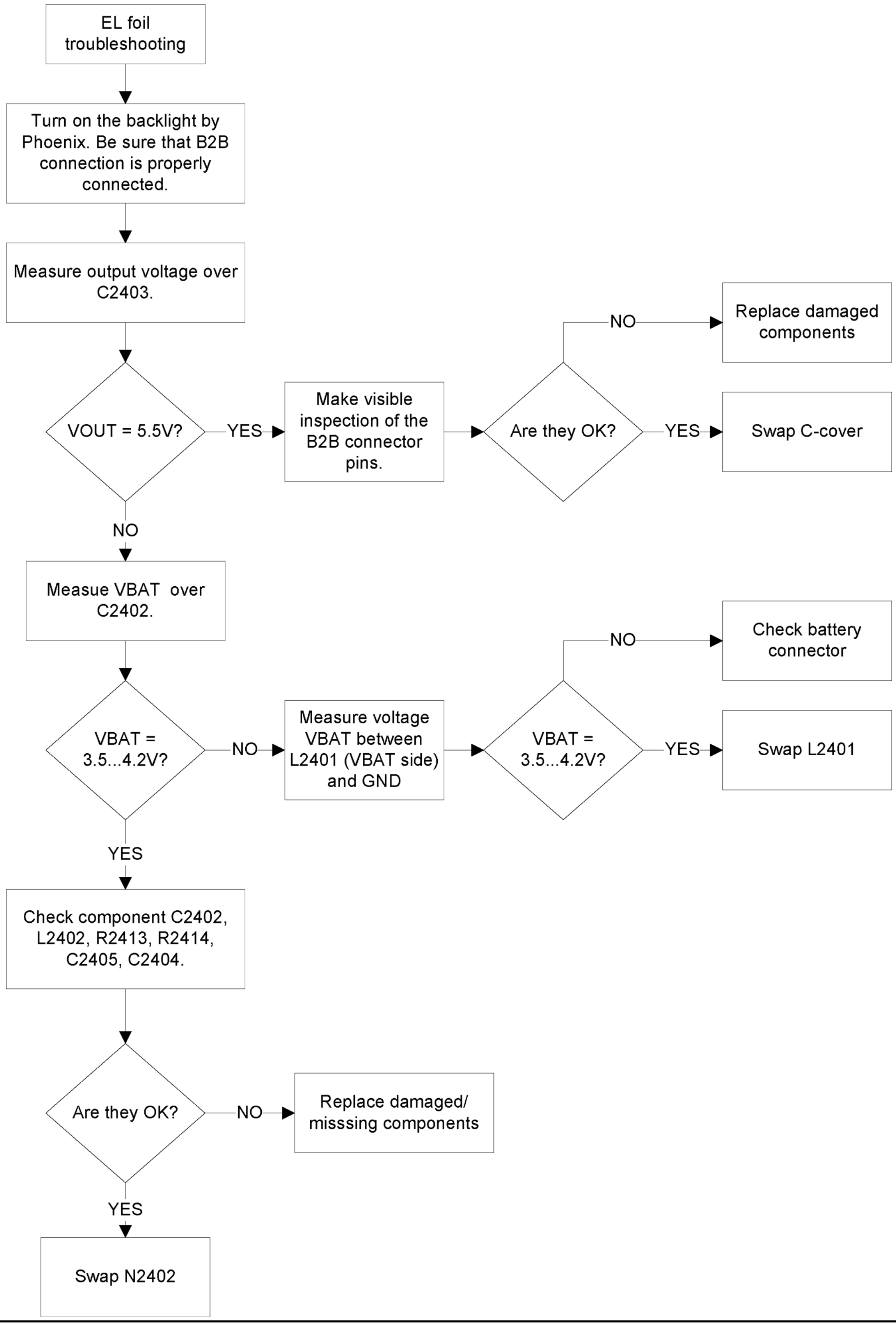

Display troubleshooting Part I
Be sure that coax cable is OK and B2B connectors as well as display connector are properly connected. Turn on the backlight by Phoenix. Replace display by a known good display module.
Does it work now?
YES
Display is faulty. Swap display.
NO
Is the backlight visible?
NO
Go to "backlight troubleshooting"
YES
Measure VIO_LCD over C1006 on LID PWB.
VIO_LCD = 1.8V?
NO
Measure voltage VIO_LCD between L1001 (VIO_LCD side) and GND
VIO_LCD = 1.8V?
YES
Swap L1001
NO
Check coax cable and B2B connectors.
Are they OK?
NO
Replace damaged/ misssing component
YES
Go to "General power checking troubleshooting"
YES
Measure VAUX over C1020 on LID PWB.
VAUX = 2.78V?
NO
Measure voltage VAUX between L1004 (VAUX side) and GND
VAUX = 2.78V?
NO
YES
Swap L1004
YES
Check display ASIP Z2401.
Is the ASIP OK?
NO
Swap Z2401
YES
Go to Rapido troubleshooting

Backlights troubleshooting

The phone has two illumination drivers. One of them provides the LED current for both displays and the media keys. Either main display or both cover UI display and media keys are illuminated. The other one provides a constant pre voltage for the EL foil high voltage driver. Both EL foil and high voltage regulator can't repair separately because they are part of the UI PWB and glued on C-cover. So all repair activities only refer to the engine PWB.

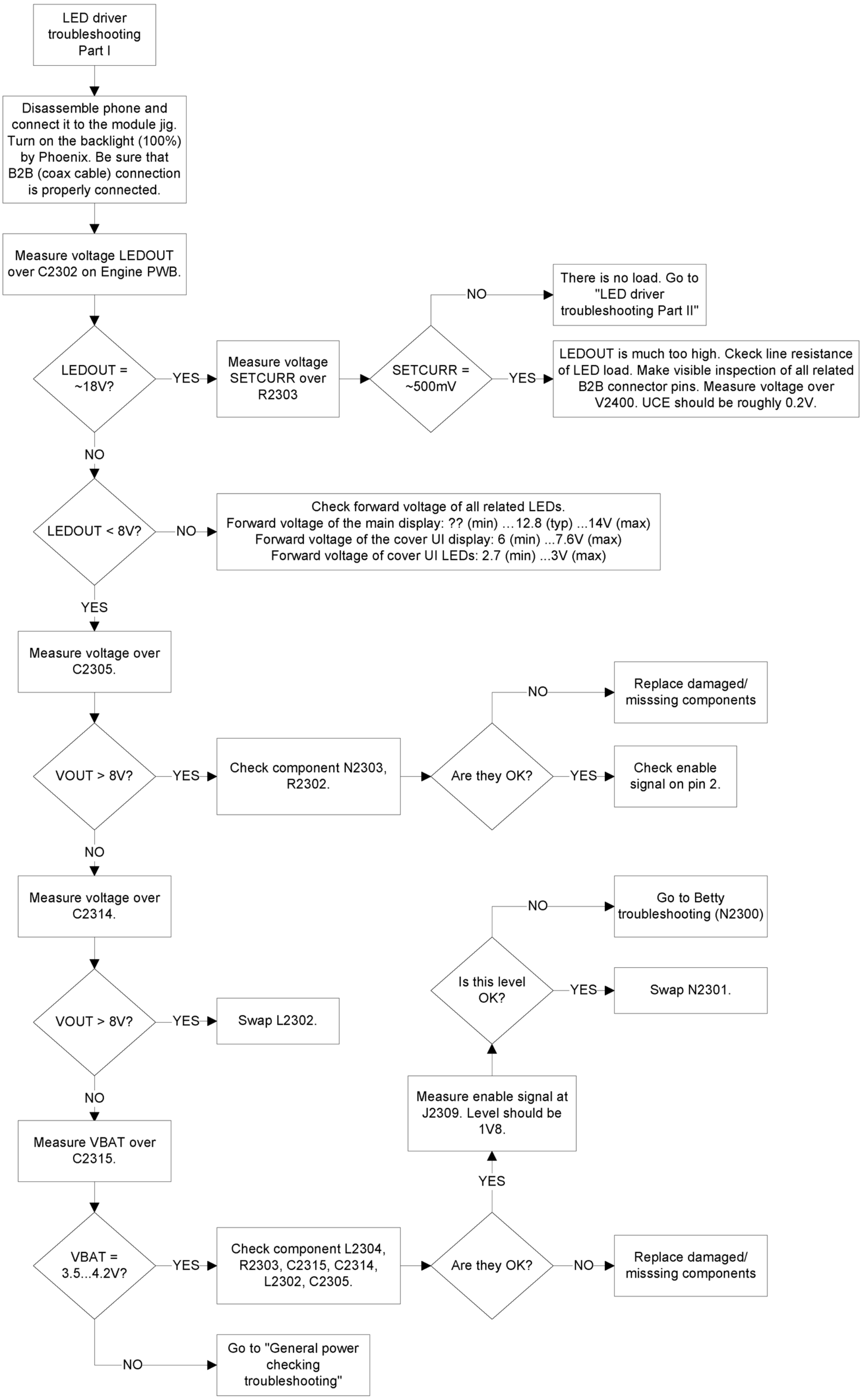
EL foil backlight troubleshooting

Troubleshooting flow

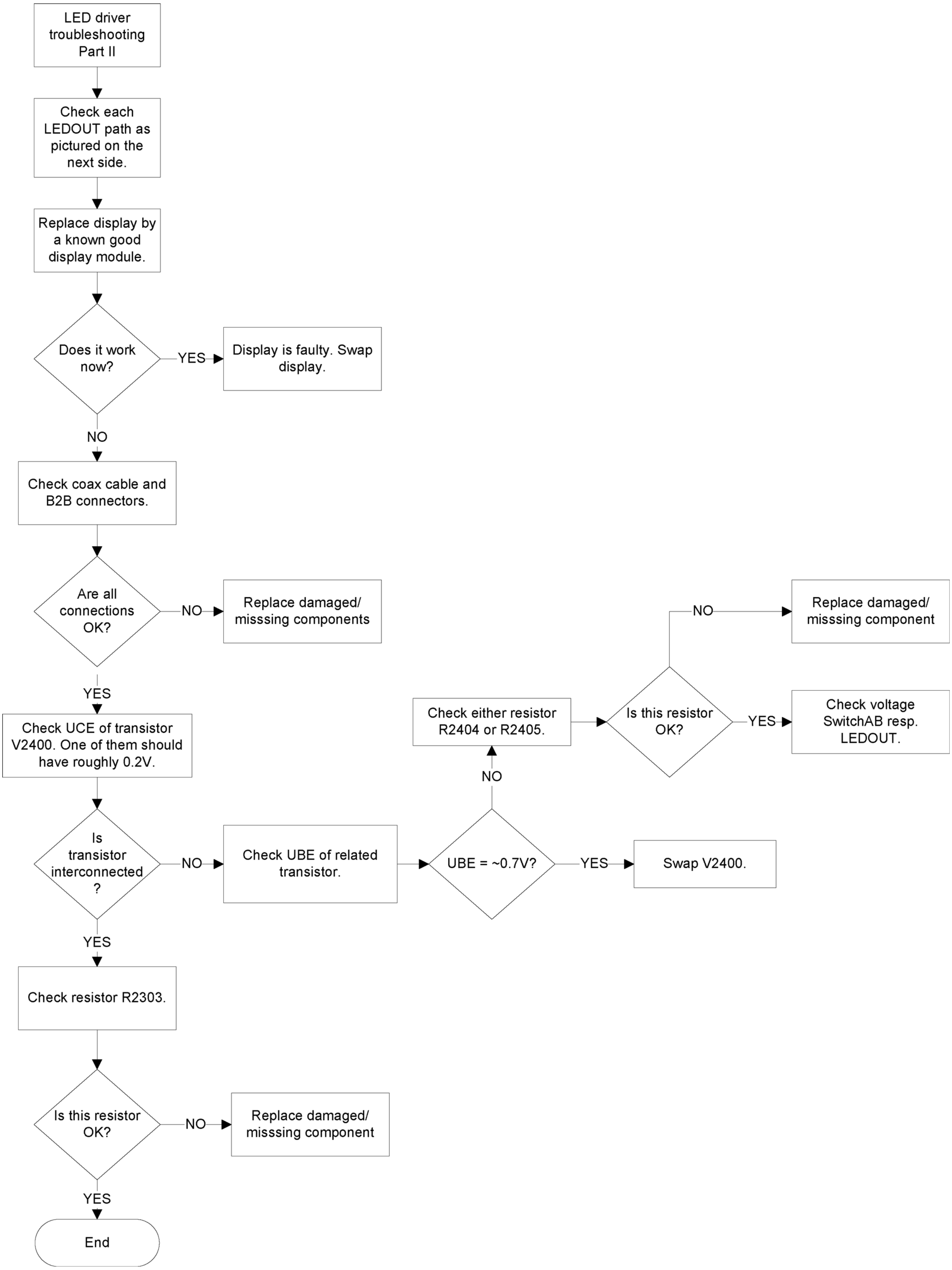

EL foil troubleshooting
Turn on the backlight by Phoenix. Be sure that B2B connection is properly connected.
Measure output voltage over C2403.
VOUT = 5.5V?
YES
Make visible inspection of the B2B connector pins.
Are they OK?
NO
Replace damaged components
YES
Swap C-cover
NO
Measue VBAT over C2402.
VBAT = 3.5...4.2V?
NO
Measure voltage VBAT between L2401 (VBAT side) and GND
VBAT = 3.5...4.2V?
NO
Check battery connector
YES
Swap L2401
YES
Check component C2402, L2402, R2413, R2414, C2405, C2404.
Are they OK?
NO
Replace damaged/ misssing components
YES
Swap N2402

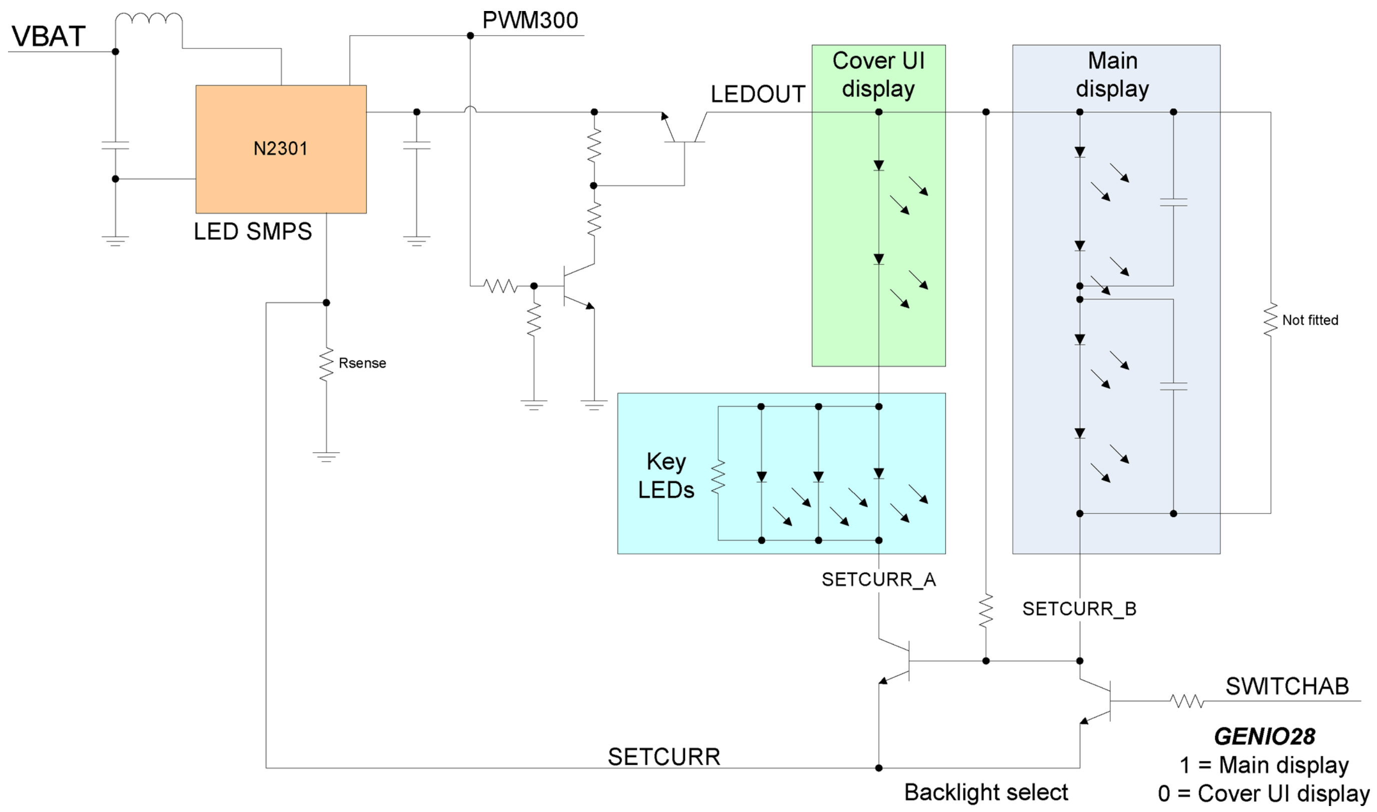
LED driver troubleshooting

LED driver troubleshooting part 1


LED driver troubleshooting Part I
Disassemble phone and connect it to the module jig. Turn on the backlight (100%) by Phoenix. Be sure that B2B (coax cable) connection is properly connected.
Measure voltage LEDOUT over C2302 on Engine PWB.
LEDOUT = ~18V?
YES
Measure voltage SETCURR over R2303
SETCURR = ~500mV
NO
There is no load. Go to "LED driver troubleshooting Part II"
YES
LEDOUT is much too high. Ckeck line resistance of LED load. Make visible inspection of all related B2B connector pins. Measure voltage over V2400. UCE should be roughly 0.2V.
NO
LEDOUT < 8V?
NO
Check forward voltage of all related LEDs.
Forward voltage of the main display: ?? (min) …12.8 (typ) ...14V (max)
Forward voltage of the cover UI display: 6 (min) ...7.6V (max)
Forward voltage of cover UI LEDs: 2.7 (min) ...3V (max)
YES
Measure voltage over C2305.
VOUT > 8V?
YES
Check component N2303, R2302.
Are they OK?
NO
Replace damaged/ misssing components
YES
Check enable signal on pin 2.
NO
Measure voltage over C2314.
VOUT > 8V?
YES
Swap L2302.
NO
Measure VBAT over C2315.
VBAT = 3.5...4.2V?
YES
Check component L2304, R2303, C2315, C2314, L2302, C2305.
Are they OK?
NO
Replace damaged/ misssing components
YES
Measure enable signal at J2309. Level should be 1V8.
Is this level OK?
NO
Go to Betty troubleshooting (N2300)
YES
Swap N2301.
NO
Go to "General power checking troubleshooting"

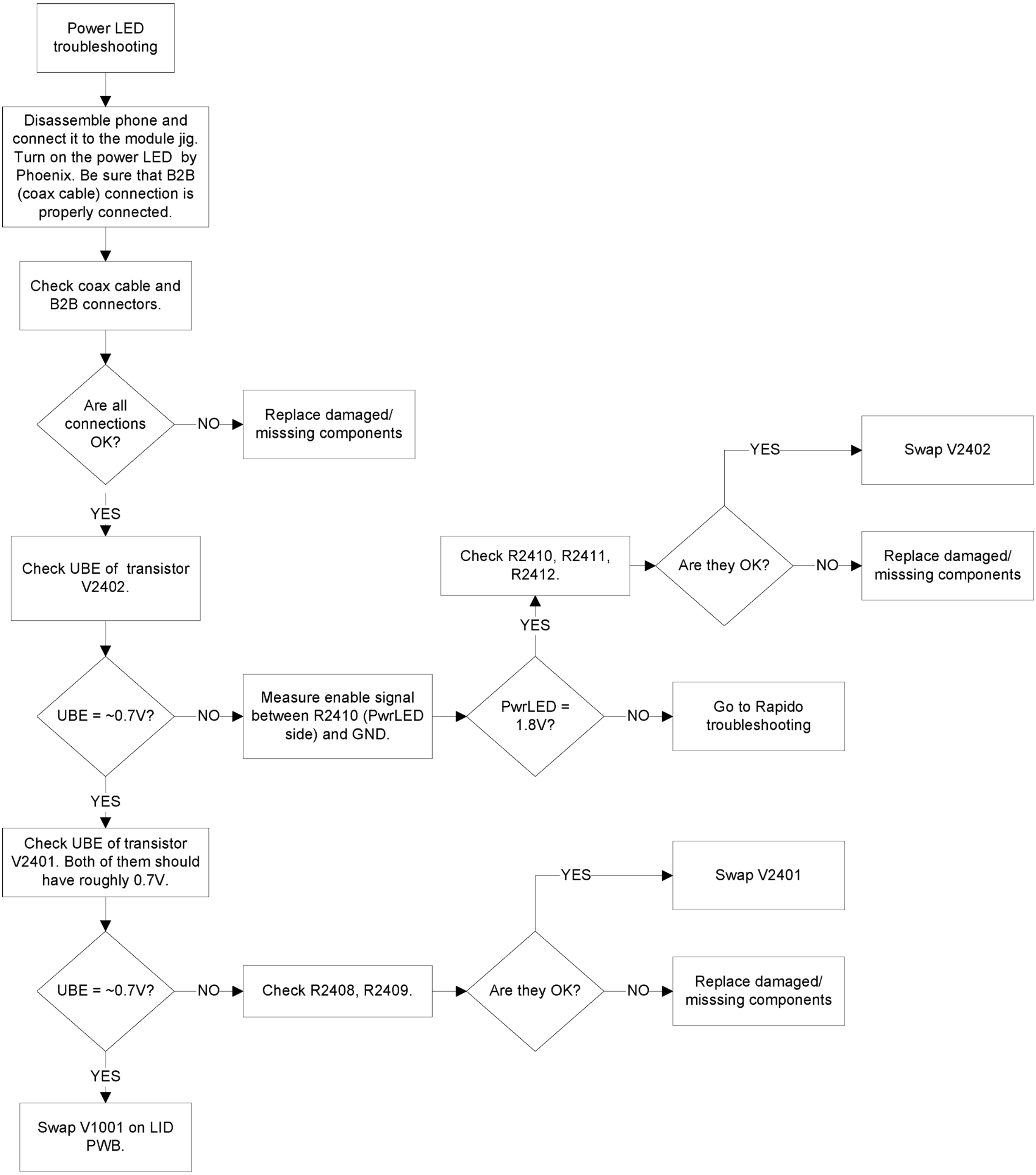
LED driver troubleshooting part 2


LED driver troubleshooting Part II
Check each LEDOUT path as pictured on the next side.
Replace display by a known good display module.
Does it work now?
YES
Display is faulty. Swap display.
NO
Check coax cable and B2B connectors.
Are all connections OK?
NO
Replace damaged/ missing components
YES
Check UCE of transistor V2400. One of them should have roughly 0.2V.
Is transistor interconnected ?
NO
Check UBE of related transistor.
UBE = ~0.7V?
YES
Swap V2400.
NO
Check either resistor R2404 or R2405.
Is this resistor OK?
NO
Replace damaged/ missing component
YES
Check voltage SwitchAB resp. LEDOUT.
YES
Check resistor R2303.
Is this resistor OK?
NO
Replace damaged/ missing component
YES
End


VBAT
PWM300
N2301
LED SMPS
LEDOUT
Cover UI display
Main display
Not fitted
Rsense
Key LEDs
SETCURR_A
SETCURR_B
SWITCHAB
GENIO28
1 = Main display
0 = Cover UI display
SETCURR
Backlight select

Power LED troubleshooting

Troubleshooting flow


Power LED troubleshooting
Disassemble phone and connect it to the module jig. Turn on the power LED by Phoenix. Be sure that B2B (coax cable) connection is properly connected.
Check coax cable and B2B connectors.
Are all connections OK?
NO
Replace damaged/ misssing components
YES
Check UBE of transistor V2402.
UBE = ~0.7V?
NO
Measure enable signal between R2410 (PwrLED side) and GND.
PwrLED = 1.8V?
NO
Go to Rapido troubleshooting
YES
Check R2410, R2411, R2412.
Are they OK?
YES
Swap V2402
NO
Replace damaged/ misssing components
YES
Check UBE of transistor V2401. Both of them should have roughly 0.7V.
UBE = ~0.7V?
NO
Check R2408, R2409.
Are they OK?
YES
Swap V2401
NO
Replace damaged/ misssing components
YES
Swap V1001 on LID PWB.

■ Bluetooth and FM radio

Introduction to Bluetooth/FM Radio troubleshooting

There are two main Bluetooth problems that can occur:

Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB.
A malfunction in the BT ASIC, BB ASICs or Phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component.

Bluetooth antenna

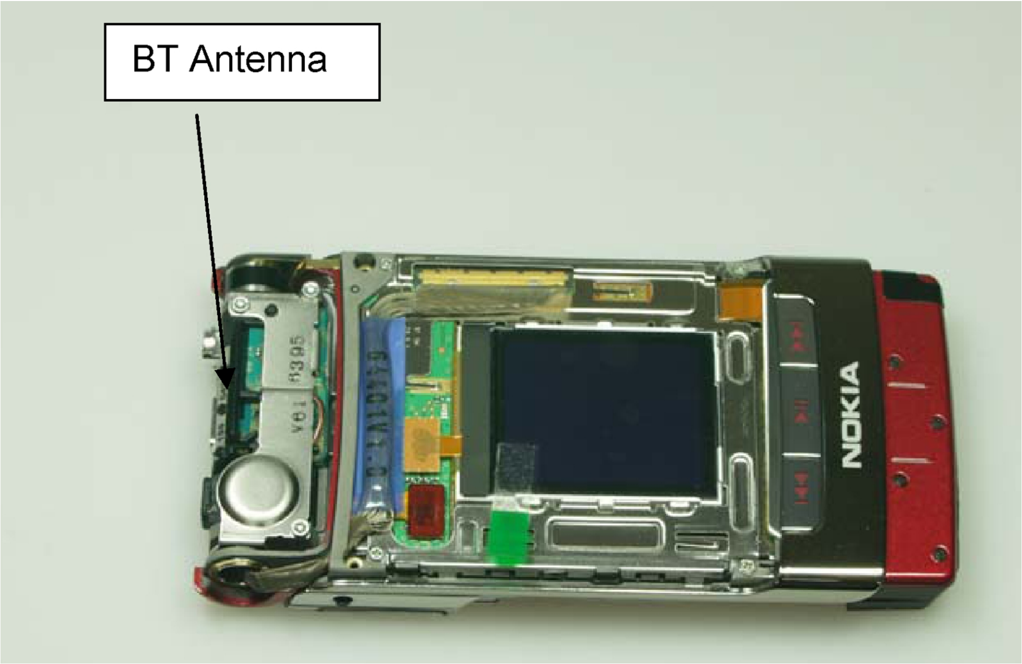


Figure 43 Bluetooth antenna

Bluetooth/FM Radio component layout

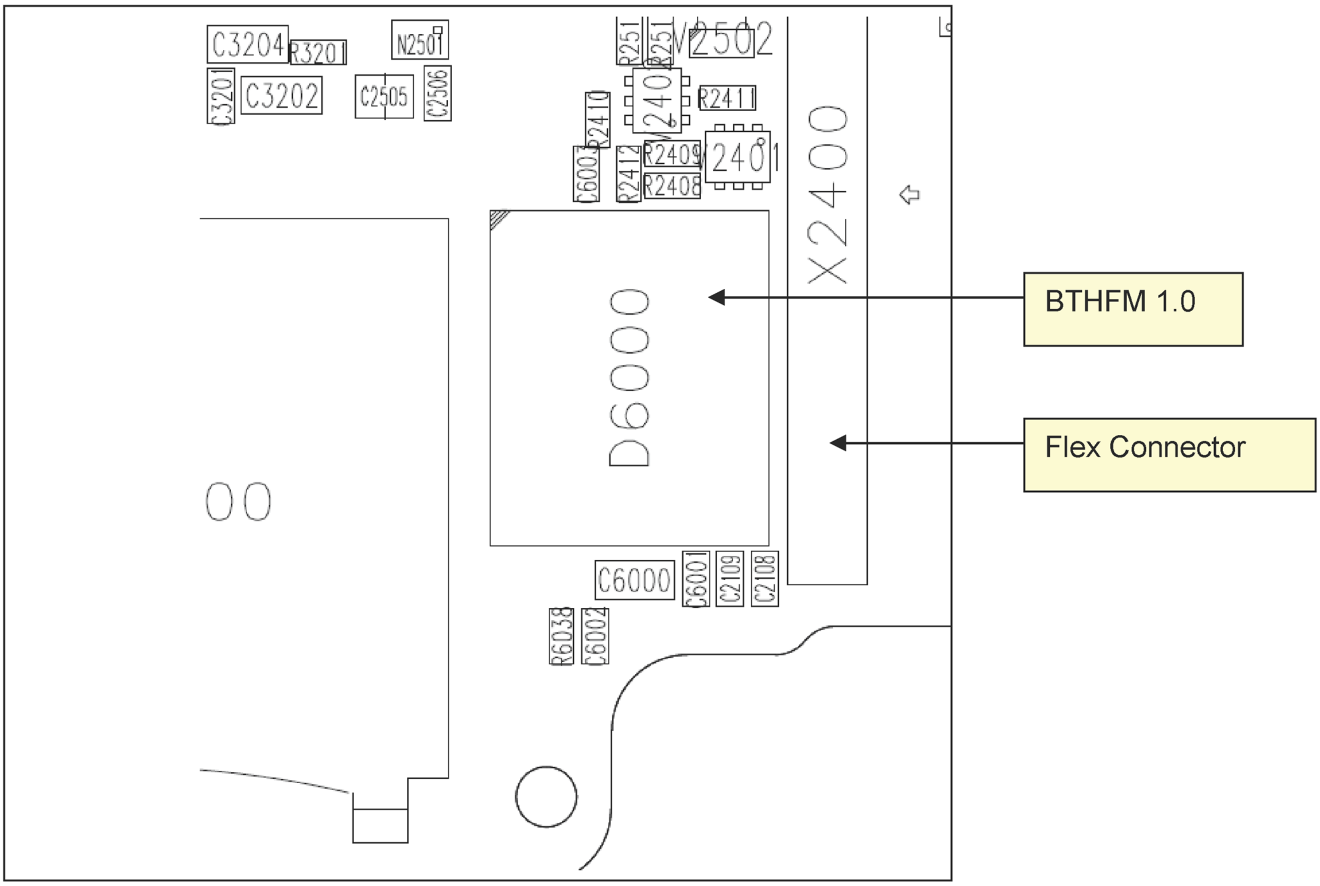

C3204
R3201
N2501
C3201
C3202
C2505
C2506
R251
R251
V2502
240
R2411
R2410
C6003
R2412
R2409
R2408
V2401
X2400
D6000
BTHFM 1.0
Flex Connector
00
C6000
C6001
C2109
C2108
R6038
C6002

Figure 44 Bluetooth and FM radio component layout

Bluetooth settings for Phoenix

Steps

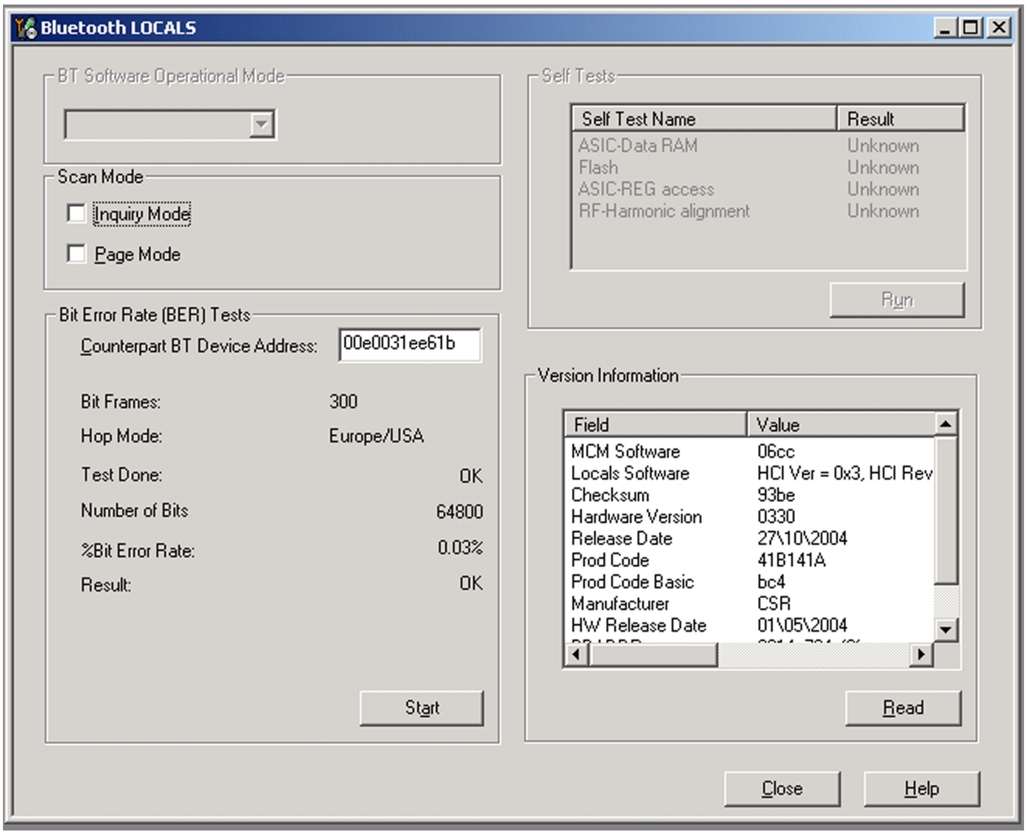
1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing→Bluetooth LOCALS** .
5. Locate JBT-9's serial number (12 digits) found in the type label on the back of JBT-9.

   In addition to JBT-9, also SB-6, JBT-3 and JBT-6 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.

   This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click **Run BER Test**.

Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.


Bluetooth LOCALS
BT Software Operational Mode
Scan Mode
Bit Error Rate (BER) Tests
Self Tests
Run
Version Information
Start
Read
Close
Help

☐ Inquiry Mode
☐ Page Mode

Counterpart BT Device Address: 00e0031ee61b

Bit Frames: 300
Hop Mode: Europe/USA
Test Done: OK
Number of Bits: 64800
%Bit Error Rate: 0.03%
Result: OK

Self Test Name	Result
ASIC-Data RAM	Unknown
Flash	Unknown
ASIC-REG access	Unknown
RF-Harmonic alignment	Unknown

Field	Value
MCM Software	06cc
Locals Software	HCI Ver = 0x3, HCI Rev
Checksum	93be
Hardware Version	0330
Release Date	27\10\2004
Prod Code	41B141A
Prod Code Basic	bc4
Manufacturer	CSR
HW Release Date	01\05\2004

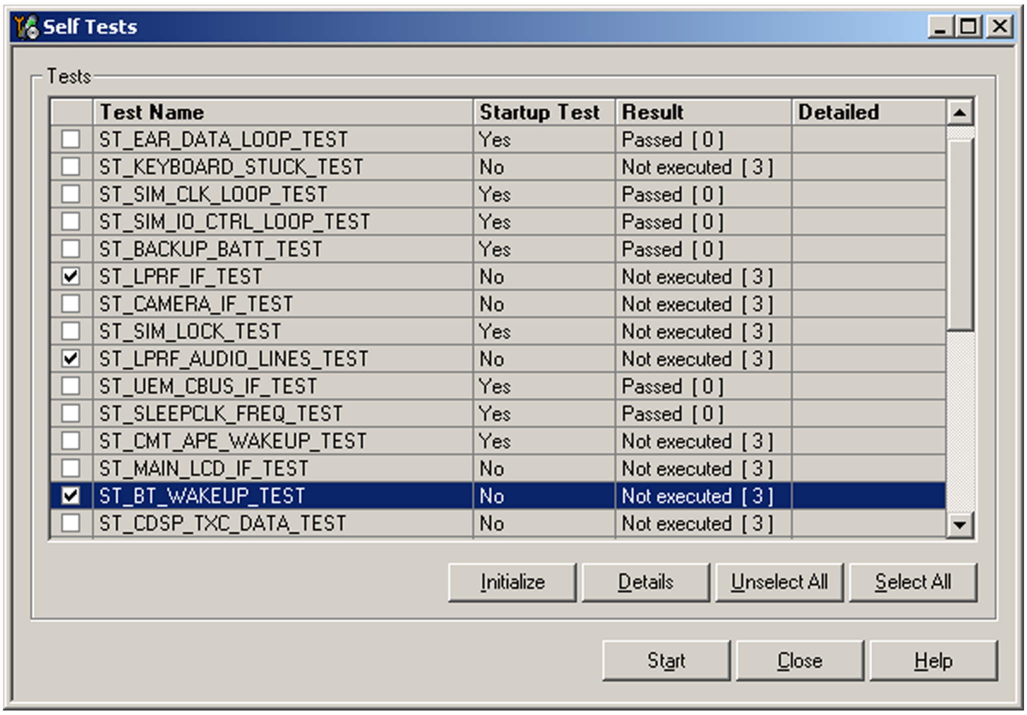
Figure 45 BER test result

Bluetooth self tests in Phoenix

Steps

1. Start *Phoenix* service software.
2. Choose**File→Scan Product.**
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing→Self Tests.**
6. In the *Self Tests* window check the following Bluetooth related tests:
   - **ST_LPRF_IF_TEST**
   - **ST_LPRF_AUDIO_LINES_TEST**
   - **ST_BT_WAKEUP_TEST**

7. To run the tests, click **Start**.

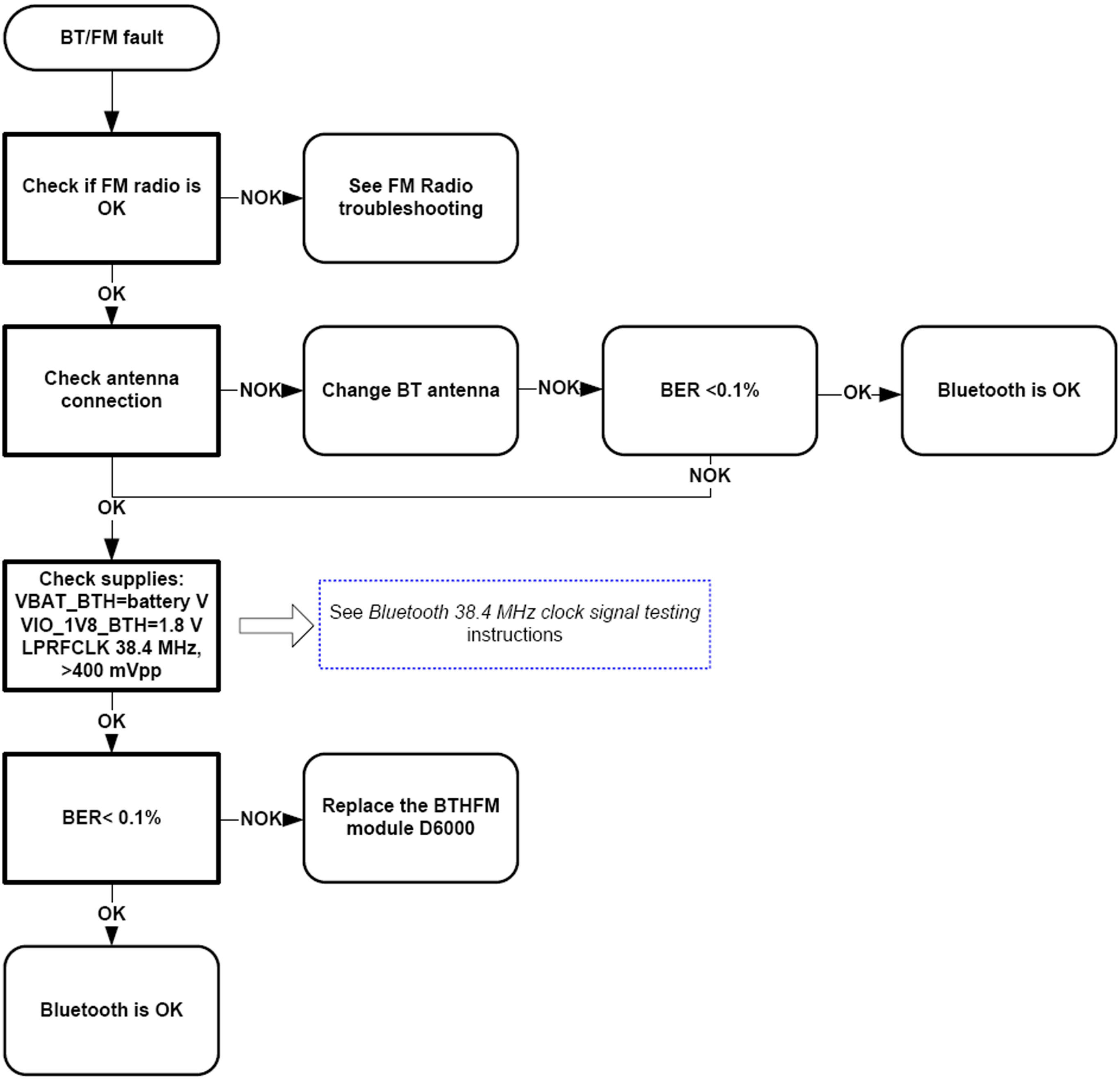


	Test Name	Startup Test	Result	Detailed
☐	ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐	ST_KEYBOARD_STUCK_TEST	No	Not executed [3]	
☐	ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐	ST_BACKUP_BATT_TEST	Yes	Passed [0]	
☑	ST_LPRF_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Not executed [3]	
☑	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_SLEEPCLK_FREQ_TEST	Yes	Passed [0]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☑	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☐	ST_CDSP_TXC_DATA_TEST	No	Not executed [3]	

Figure 46 Bluetooth self tests in *Phoenix*

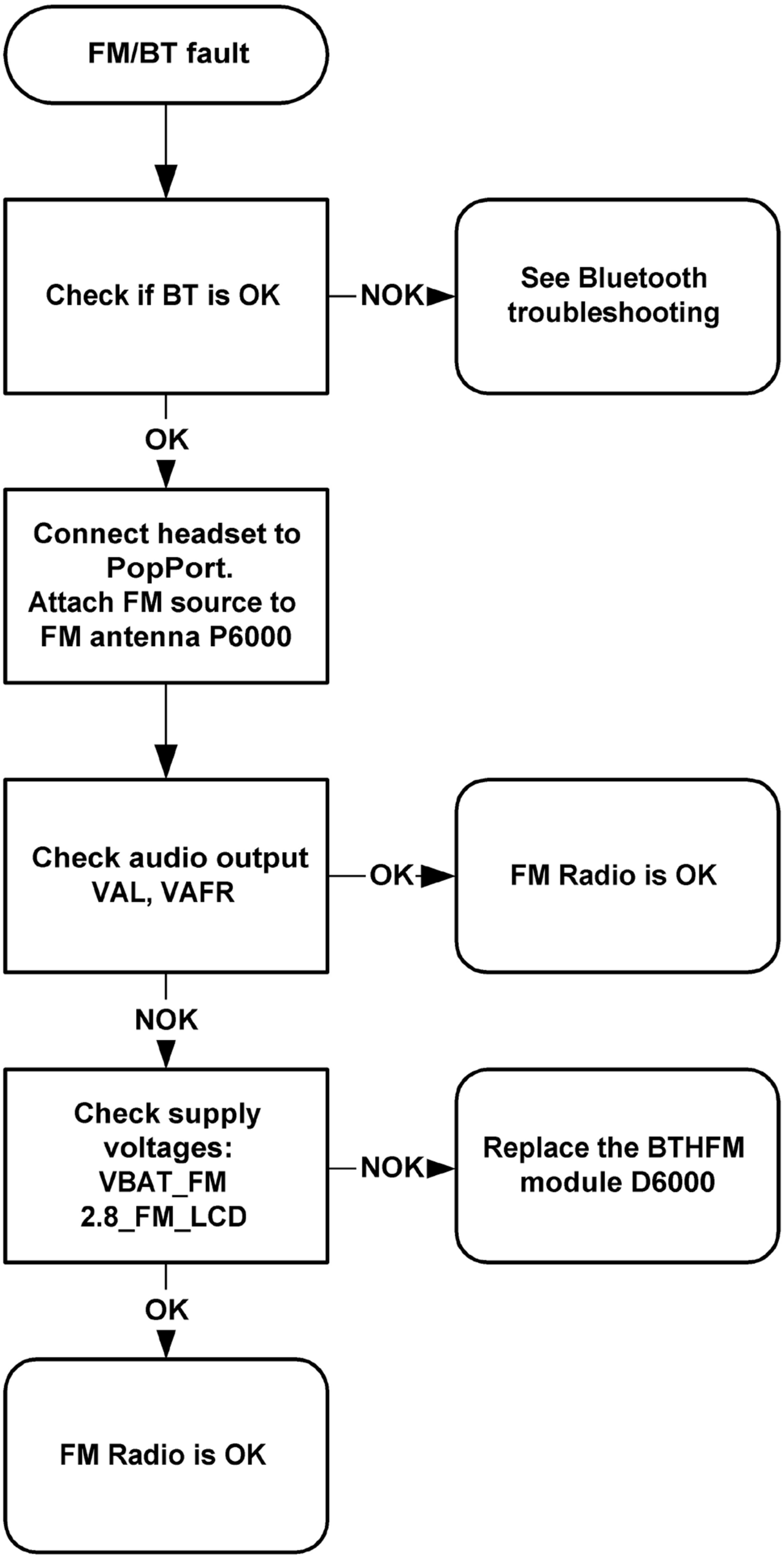
Bluetooth troubleshooting

Troubleshooting flow


BT/FM fault
Check if FM radio is OK
NOK
See FM Radio troubleshooting
OK
Check antenna connection
NOK
Change BT antenna
NOK
BER <0.1%
OK
Bluetooth is OK
NOK
OK
Check supplies: VBAT_BTH=battery V VIO_1V8_BTH=1.8 V LPRFCLK 38.4 MHz, >400 mVpp
See *Bluetooth 38.4 MHz clock signal testing* instructions
OK
BER< 0.1%
NOK
Replace the BTHFM module D6000
OK
Bluetooth is OK

FM radio troubleshooting

Troubleshooting flow


FM/BT fault
Check if BT is OK
NOK
See Bluetooth troubleshooting
OK
Connect headset to PopPort. Attach FM source to FM antenna P6000
Check audio output VAL, VAFR
OK
FM Radio is OK
NOK
Check supply voltages: VBAT_FM 2.8_FM_LCD
NOK
Replace the BTHFM module D6000
OK
FM Radio is OK

Audio troubleshooting

Audio troubleshooting test instructions

Single-ended external earpiece and differential internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential. Exception to this is a digital microphone, which needs input signal from an external sound source (laptop speaker) to playback eg. 1kHz sine wave from 5cm distance.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V
- Sound level meter
- 'Active speaker' or 'speaker and power amplifier'

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Digital stereo microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

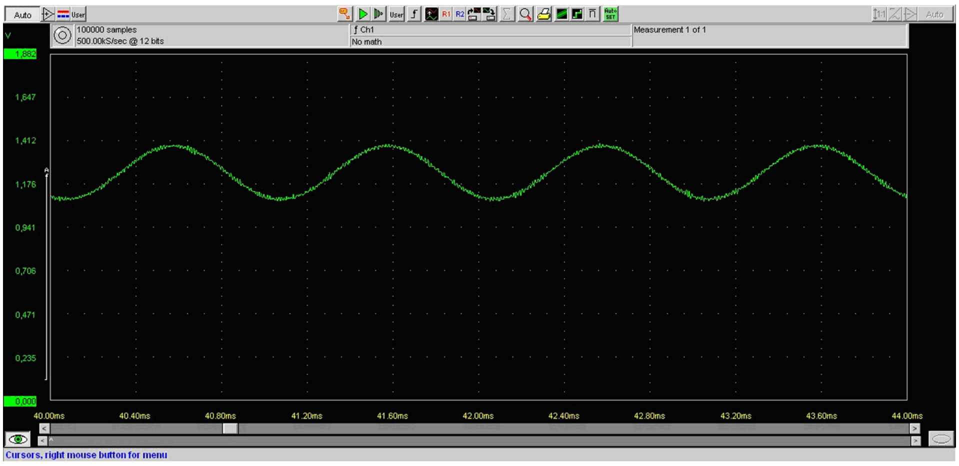
Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	HS_MIC & GND	HS_EAR_L & GND	-8.6	1000	367	1.2	NA
		HS_EAR_R & GND					
External Mic to Internal Earpiece	HS_MIC & GND	EarP & GND	-10	1000	310	1.2	NA
		EarN & GND					
External Mic to Internal handsfree	XMICP and GND	Pad J2101	8.5	920	2520	0	~25mA
	XMICN and GND	Pad J2102					
Internal Mic to External Earpiece	B2100 OUT and GND	HSEAR P, HSEAR N and GND	22.7	100	1330	1.2	

Measurement data

Earpiece signal

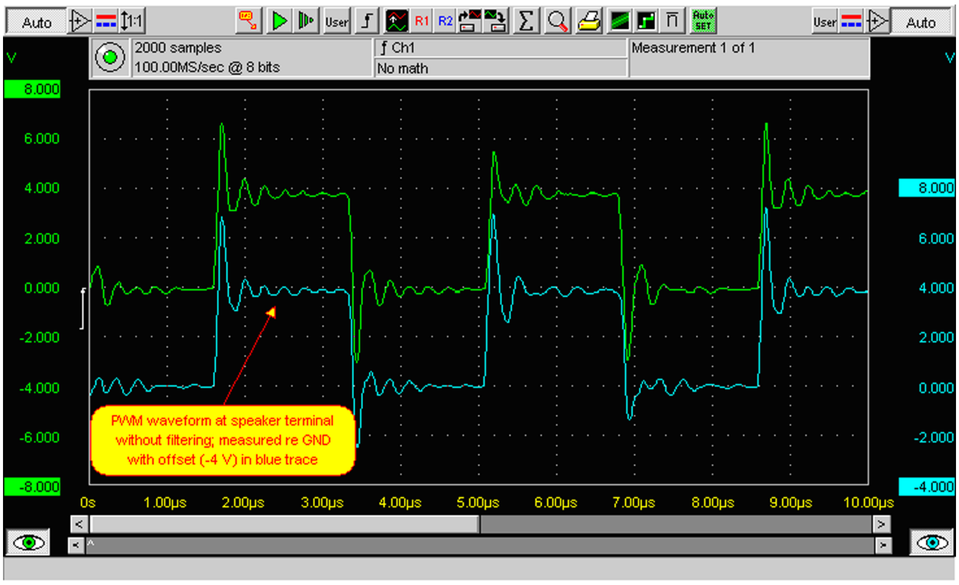


100000 samples
500.00kS/sec @ 12 bits
ƒ Ch1
No math
Measurement 1 of 1
Cursors, right mouse button for menu

Auto
User
User
R1
R2
Auto SET
Auto
V
1,882
1,647
1,412
1,176
0,941
0,706
0,471
0,235
0,000
40.00ms
40.40ms
40.80ms
41.20ms
41.60ms
42.00ms
42.40ms
42.80ms
43.20ms
43.60ms
44.00ms

Figure 47 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.

Integrated handsfree signal



2000 samples
100.00MS/sec @ 8 bits

ƒ Ch1
No math

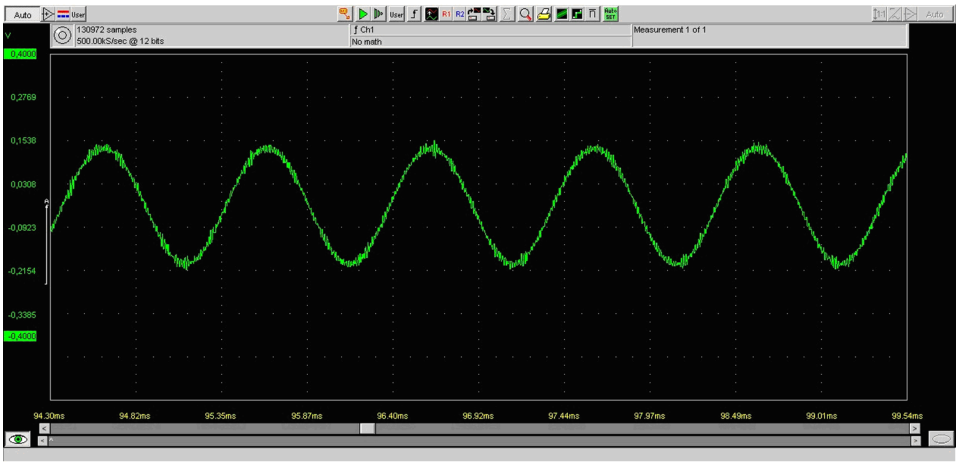
Measurement 1 of 1

PWM waveform at speaker terminal without filtering; measured re GND with offset (-4 V) in blue trace

Auto
User
Auto
V
8.000
6.000
4.000
2.000
0.000
-2.000
-4.000
-6.000
-8.000
V
8.000
6.000
4.000
2.000
0.000
-2.000
-4.000
0s
1.00µs
2.00µs
3.00µs
4.00µs
5.00µs
6.00µs
7.00µs
8.00µs
9.00µs
10.00µs

Figure 48 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

External output from AV



130972 samples
500.00kS/sec @ 12 bits

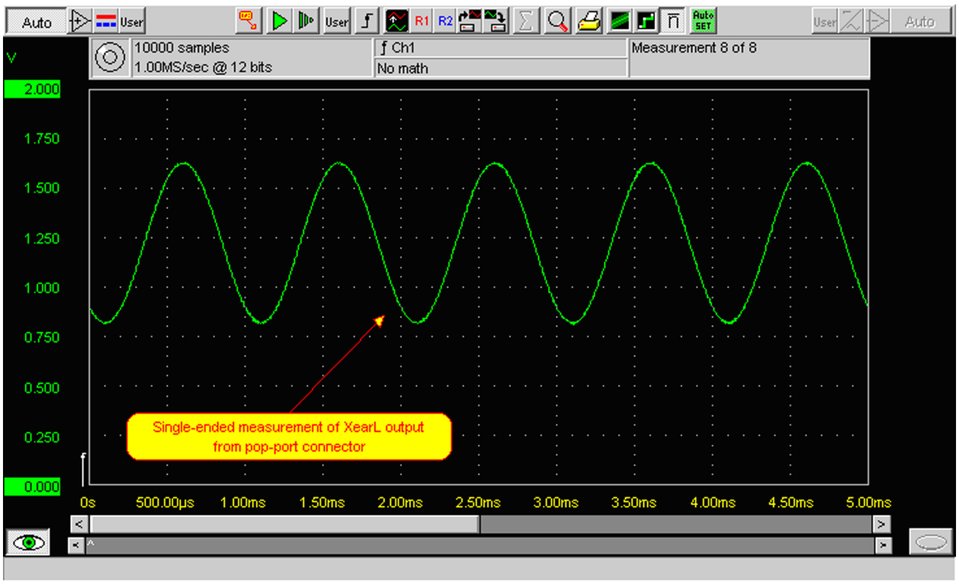
ƒ Ch1
No math

Measurement 1 of 1

Auto
User
Auto
V
0,4000
0,2769
0,1538
0,0308
-0,0923
-0,2154
-0,3385
-0,4000
94.30ms
94.82ms
95.35ms
95.87ms
96.40ms
96.92ms
97.44ms
97.97ms
98.49ms
99.01ms
99.54ms

Figure 49 Single-ended output waveform of the Ext_in_Ext_out loop.

External output from AV (acoustic input)

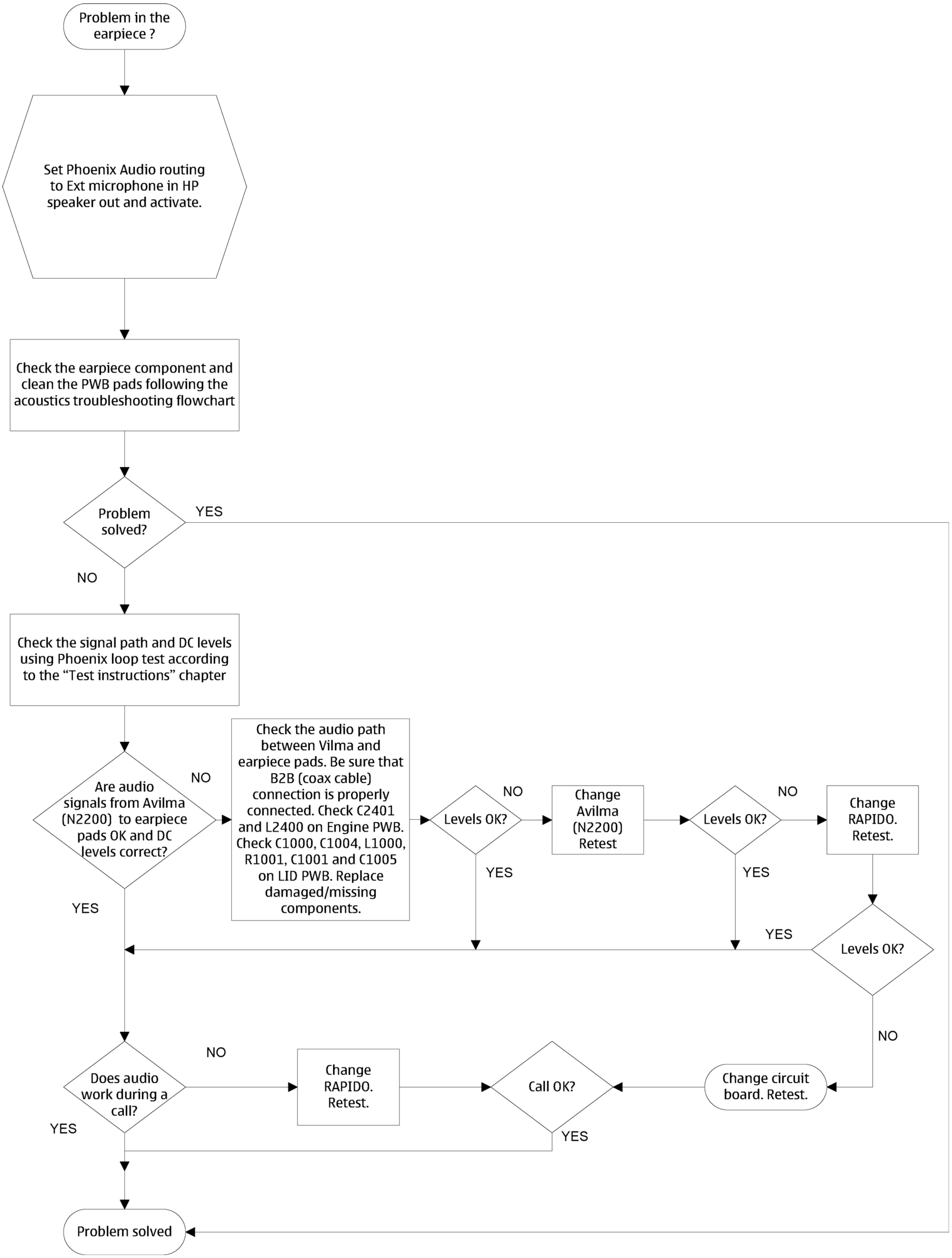

Auto
User
User
R1
R2
Auto SET
User
Auto
V
10000 samples
1.00MS/sec @ 12 bits
ƒ Ch1
No math
Measurement 8 of 8
2.000
1.750
1.500
1.250
1.000
0.750
0.500
0.250
0.000
0s
500.00µs
1.00ms
1.50ms
2.00ms
2.50ms
3.00ms
3.50ms
4.00ms
4.50ms
5.00ms

Single-ended measurement of XearL output from pop-port connector

Figure 50 Single-ended output waveform of the HP_in_Ext_out loop.

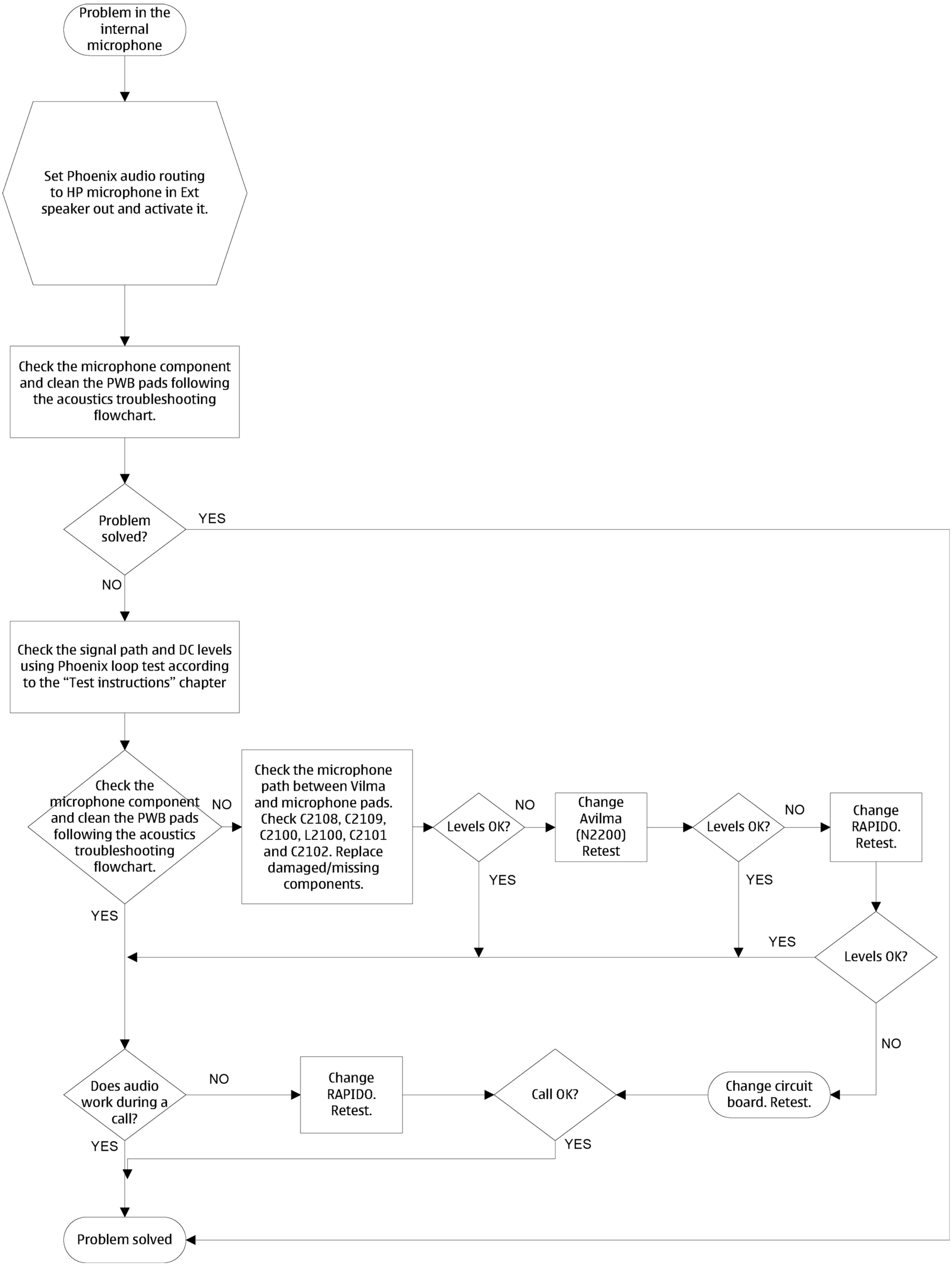
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the earpiece ?
Set Phoenix Audio routing to Ext microphone in HP speaker out and activate.
Check the earpiece component and clean the PWB pads following the acoustics troubleshooting flowchart
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the "Test instructions" chapter
Are audio signals from Avilma (N2200) to earpiece pads OK and DC levels correct?
NO
YES
Check the audio path between Vilma and earpiece pads. Be sure that B2B (coax cable) connection is properly connected. Check C2401 and L2400 on Engine PWB. Check C1000, C1004, L1000, R1001, C1001 and C1005 on LID PWB. Replace damaged/missing components.
Levels OK?
NO
YES
Change Avilma (N2200) Retest
Levels OK?
NO
YES
Change RAPIDO. Retest.
Levels OK?
YES
NO
Change circuit board. Retest.
Does audio work during a call?
NO
YES
Change RAPIDO. Retest.
Call OK?
YES
Problem solved

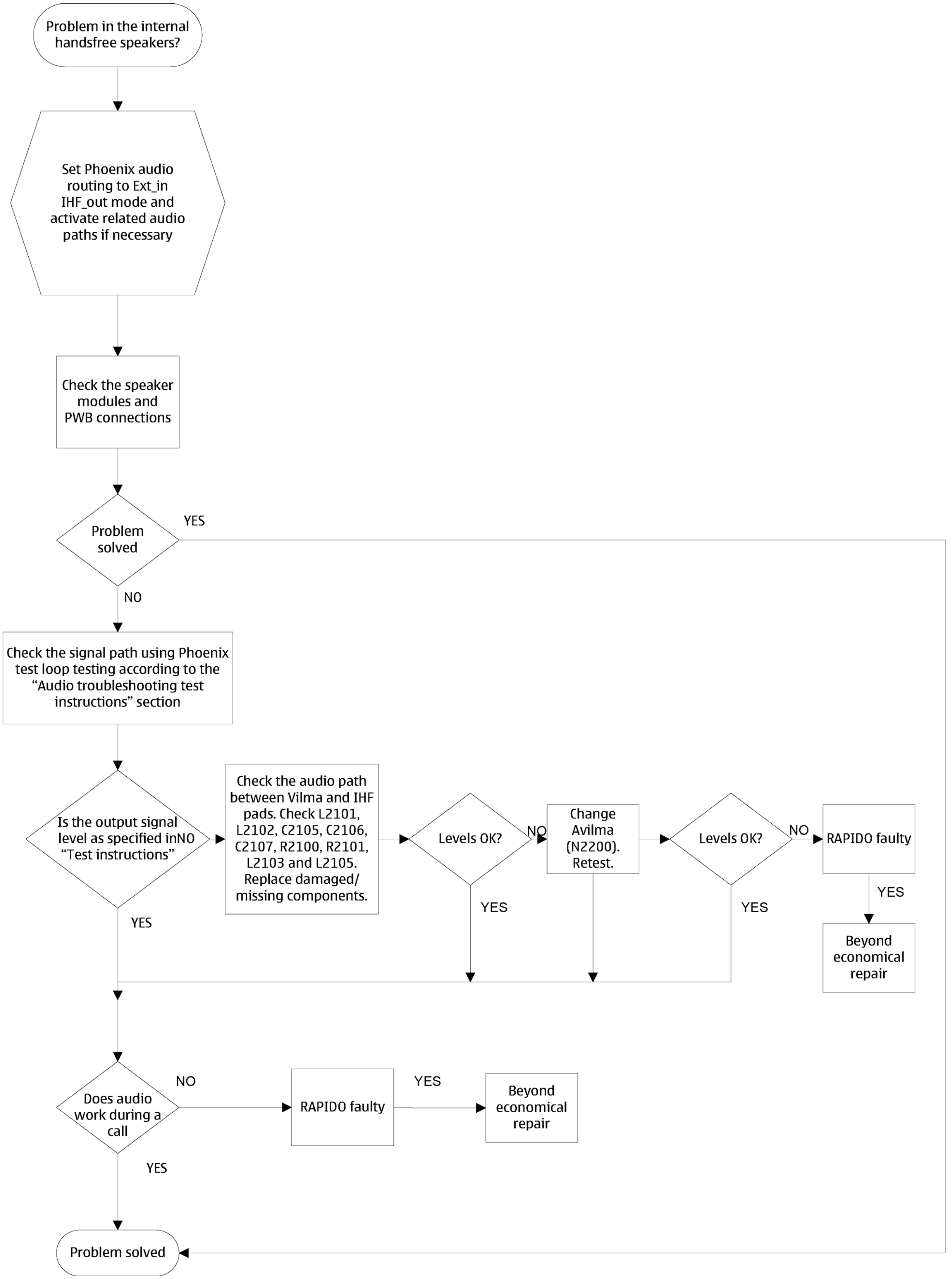
Internal microphone troubleshooting

Troubleshooting flow


Problem in the internal microphone
Set Phoenix audio routing to HP microphone in Ext speaker out and activate it.
Check the microphone component and clean the PWB pads following the acoustics troubleshooting flowchart.
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the "Test instructions" chapter
Check the microphone component and clean the PWB pads following the acoustics troubleshooting flowchart.
NO
Check the microphone path between Vilma and microphone pads. Check C2108, C2109, C2100, L2100, C2101 and C2102. Replace damaged/missing components.
Levels OK?
NO
Change Avilma (N2200) Retest
Levels OK?
NO
Change RAPIDO. Retest.
YES
YES
YES
YES
Levels OK?
NO
Does audio work during a call?
NO
Change RAPIDO. Retest.
Call OK?
Change circuit board. Retest.
YES
YES
Problem solved

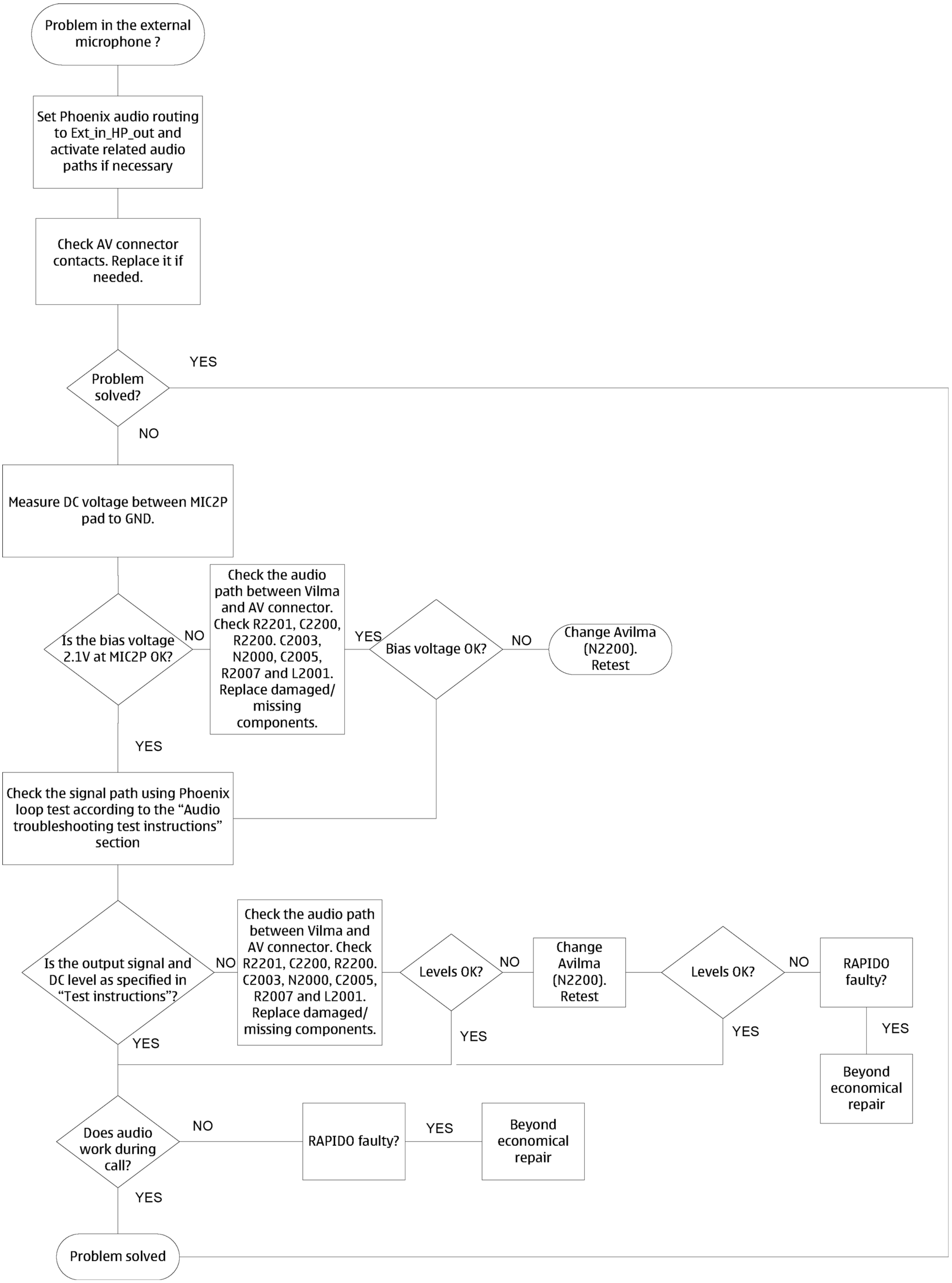
IHF speakers troubleshooting

Troubleshooting flow


Problem in the internal handsfree speakers?
Set Phoenix audio routing to Ext_in IHF_out mode and activate related audio paths if necessary
Check the speaker modules and PWB connections
Problem solved
YES
NO
Check the signal path using Phoenix test loop testing according to the "Audio troubleshooting test instructions" section
Is the output signal level as specified in "Test instructions"
NO
YES
Check the audio path between Vilma and IHF pads. Check L2101, L2102, C2105, C2106, C2107, R2100, R2101, L2103 and L2105. Replace damaged/ missing components.
Levels OK?
NO
YES
Change Avilma (N2200). Retest.
Levels OK?
NO
YES
RAPIDO faulty
YES
Beyond economical repair
Does audio work during a call
NO
RAPIDO faulty
YES
Beyond economical repair
YES
Problem solved

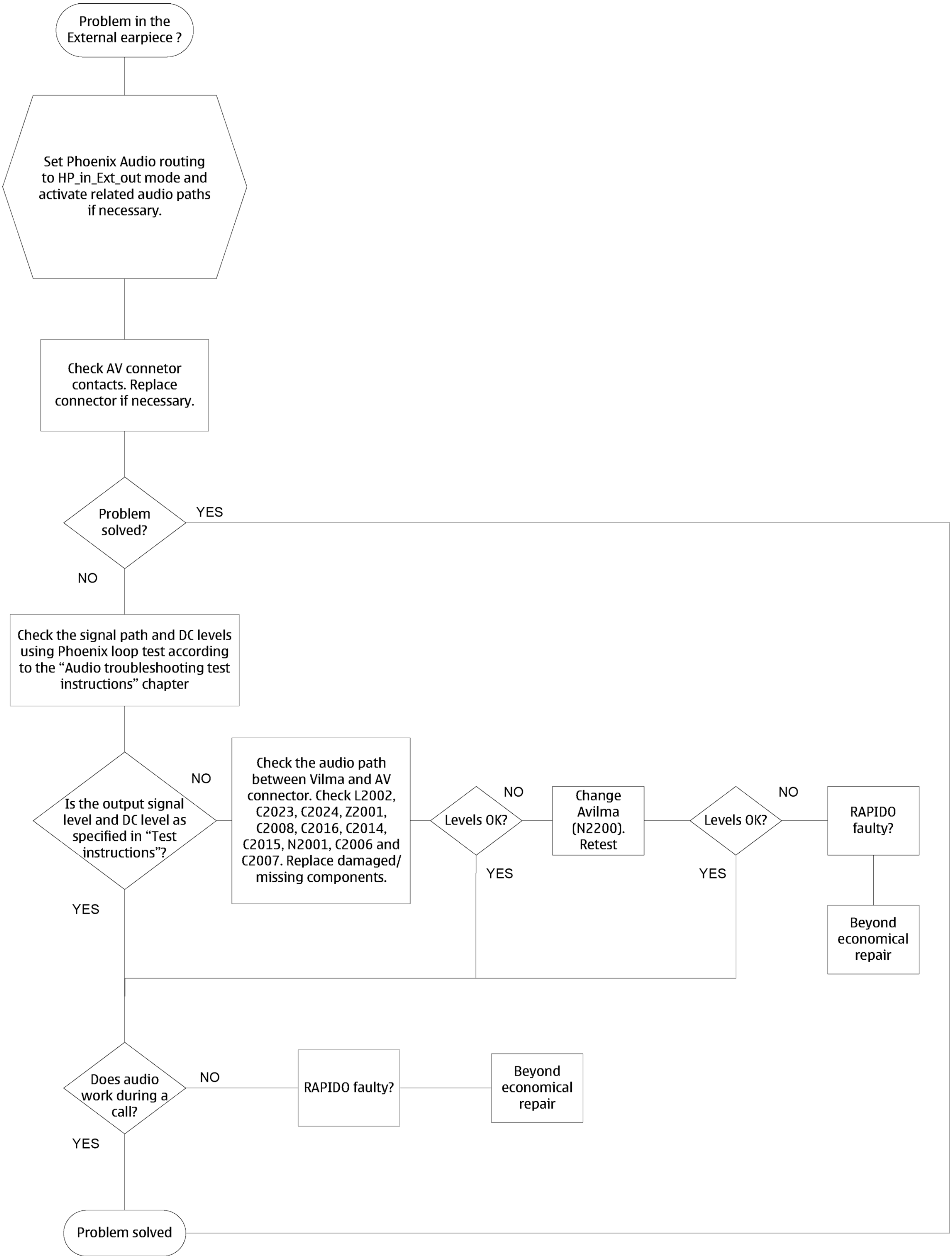
External headset microphone troubleshooting

Troubleshooting flow


Problem in the external microphone ?
Set Phoenix audio routing to Ext_in_HP_out and activate related audio paths if necessary
Check AV connector contacts. Replace it if needed.
Problem solved?
YES
NO
Measure DC voltage between MIC2P pad to GND.
Is the bias voltage 2.1V at MIC2P OK?
NO
Check the audio path between Vilma and AV connector. Check R2201, C2200, R2200. C2003, N2000, C2005, R2007 and L2001. Replace damaged/ missing components.
YES
Bias voltage OK?
NO
Change Avilma (N2200). Retest
YES
Check the signal path using Phoenix loop test according to the "Audio troubleshooting test instructions" section
Is the output signal and DC level as specified in "Test instructions"?
NO
Check the audio path between Vilma and AV connector. Check R2201, C2200, R2200. C2003, N2000, C2005, R2007 and L2001. Replace damaged/ missing components.
Levels OK?
NO
Change Avilma (N2200). Retest
Levels OK?
NO
RAPIDO faulty?
YES
Beyond economical repair
YES
YES
YES
Does audio work during call?
NO
RAPIDO faulty?
YES
Beyond economical repair
YES
Problem solved

External headset earpiece troubleshooting

Troubleshooting flow


Problem in the External earpiece ?
Set Phoenix Audio routing to HP_in_Ext_out mode and activate related audio paths if necessary.
Check AV connetor contacts. Replace connector if necessary.
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the “Audio troubleshooting test instructions” chapter
Is the output signal level and DC level as specified in “Test instructions”?
NO
YES
Check the audio path between Vilma and AV connector. Check L2002, C2023, C2024, Z2001, C2008, C2016, C2014, C2015, N2001, C2006 and C2007. Replace damaged/ missing components.
Levels OK?
NO
YES
Change Avilma (N2200). Retest
Levels OK?
NO
YES
RAPIDO faulty?
Beyond economical repair
Does audio work during a call?
NO
YES
RAPIDO faulty?
Beyond economical repair
Problem solved

Acoustics troubleshooting

Introduction to acoustics troubleshooting

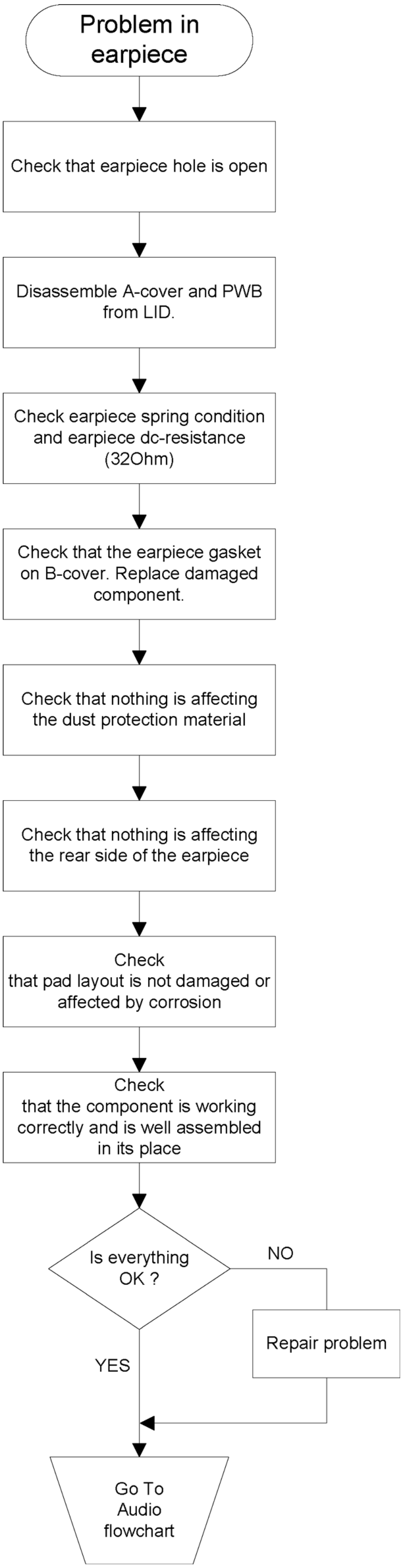
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by speaker(s). The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece readiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speakers radiates from left and right sound holes located on both sides of the device. Microphone is located at the bottom, next to the system connector.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

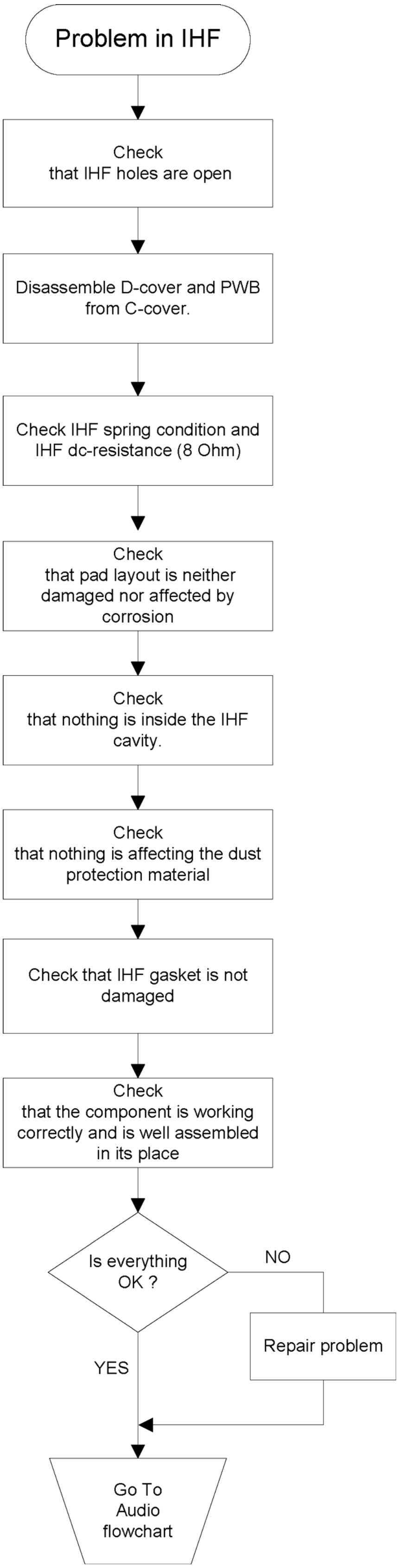
Earpiece troubleshooting

Troubleshooting flow


Problem in earpiece
Check that earpiece hole is open
Disassemble A-cover and PWB from LID.
Check earpiece spring condition and earpiece dc-resistance (32Ohm)
Check that the earpiece gasket on B-cover. Replace damaged component.
Check that nothing is affecting the dust protection material
Check that nothing is affecting the rear side of the earpiece
Check that pad layout is not damaged or affected by corrosion
Check that the component is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

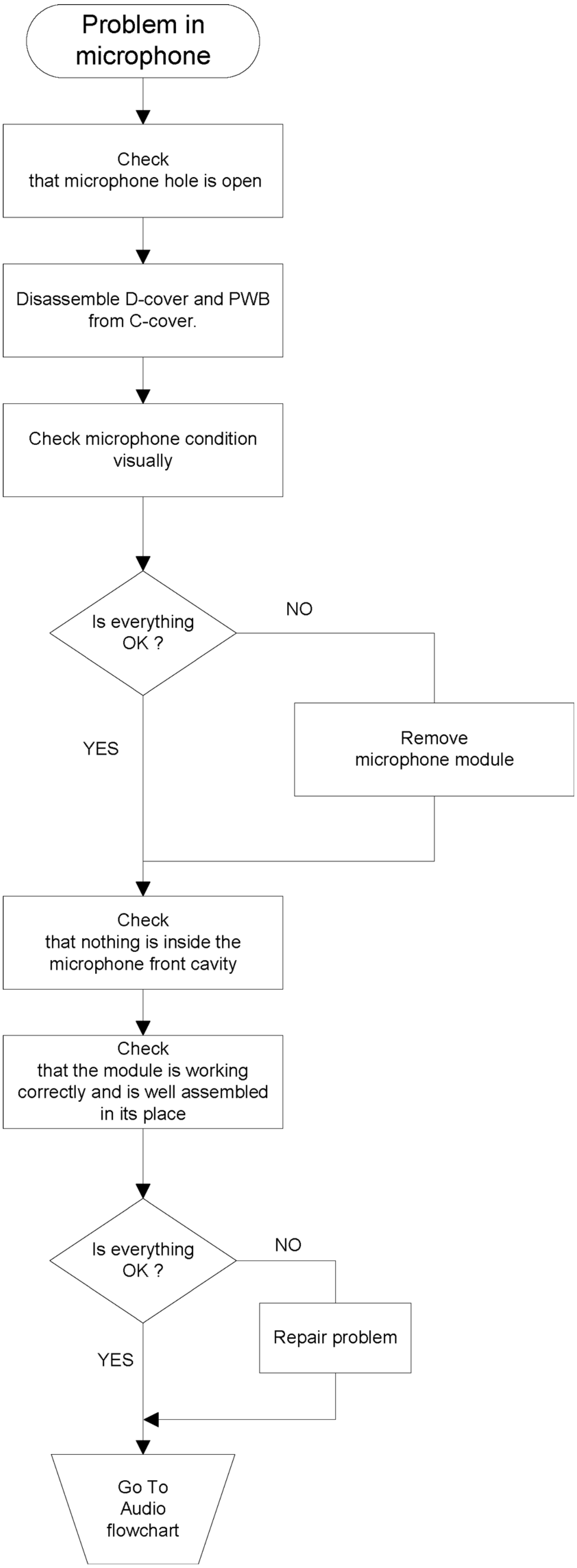
IHF troubleshooting

Troubleshooting flow


Problem in IHF
Check
that IHF holes are open
Disassemble D-cover and PWB from C-cover.
Check IHF spring condition and IHF dc-resistance (8 Ohm)
Check
that pad layout is neither damaged nor affected by corrosion
Check
that nothing is inside the IHF cavity.
Check
that nothing is affecting the dust protection material
Check that IHF gasket is not damaged
Check
that the component is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Microphone troubleshooting

Troubleshooting flow


Problem in microphone
Check that microphone hole is open
Disassemble D-cover and PWB from C-cover.
Check microphone condition visually
Is everything OK ?
NO
Remove microphone module
YES
Check that nothing is inside the microphone front cavity
Check that the module is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Baseband manual tuning guide

Certificate restoring for BB5 products

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-8 or FPS-10.

  Note: USB flashing does not work for a dead BB5 phone.
- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- Phoenix service software V2006.44.6.163 or newer
- The latest phone model specific Phoenix data package
- PK-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)

  Note: FPS-10 has an integrated smart card reader.
- Activated e.g FPS-10 flash prommer
- Flash update package V07.04.013 or newer for FPS-10 flash prommer
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

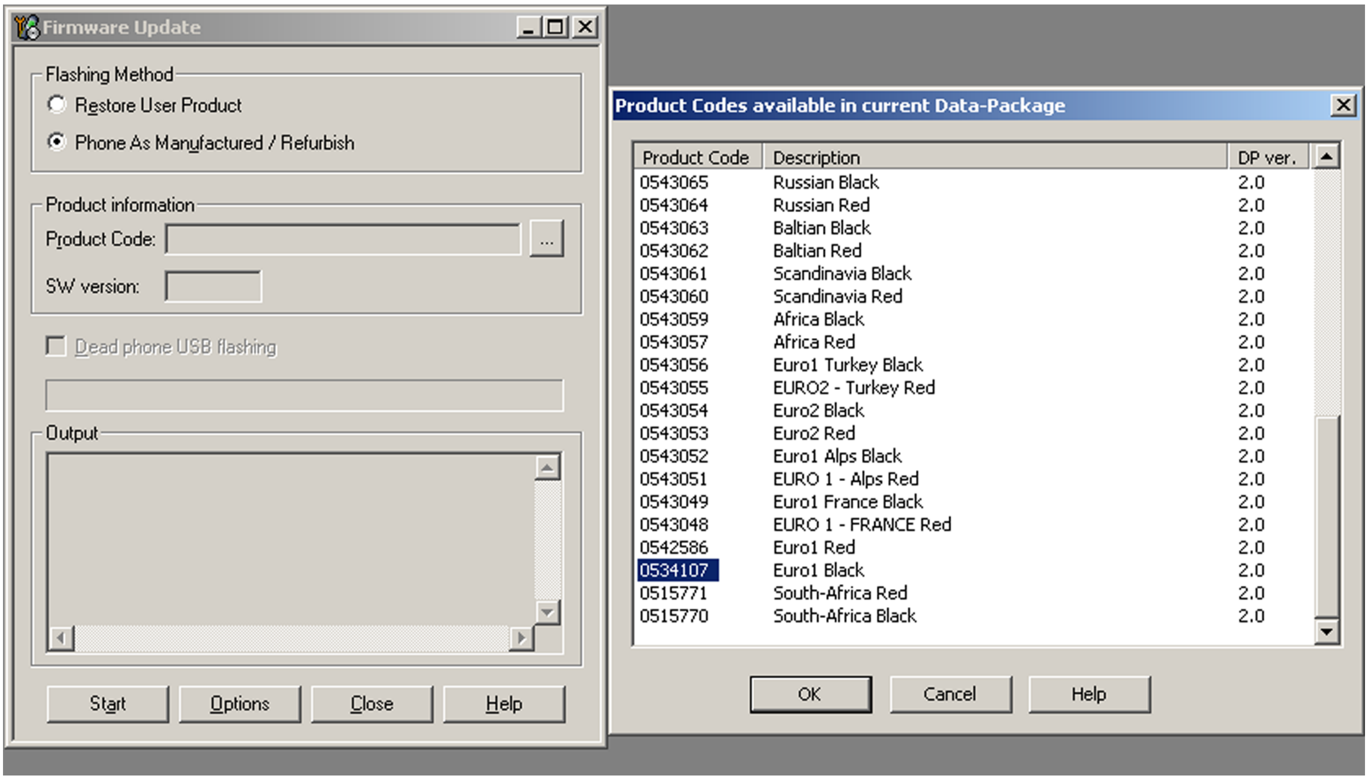
Steps

1. Program the phone software.
   i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-10.
   ii Update the phone MCU software to the latest available version.
   If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.

iii Choose the product manually from **File→Open Product** , and click **OK**.

Wait for the phone type designator (e.g. “RM-1”) to be displayed in the status bar.

iv Go to **Flashing→Firmware Update** and wait until *Phoenix* reads the product data as shown in the following picture.

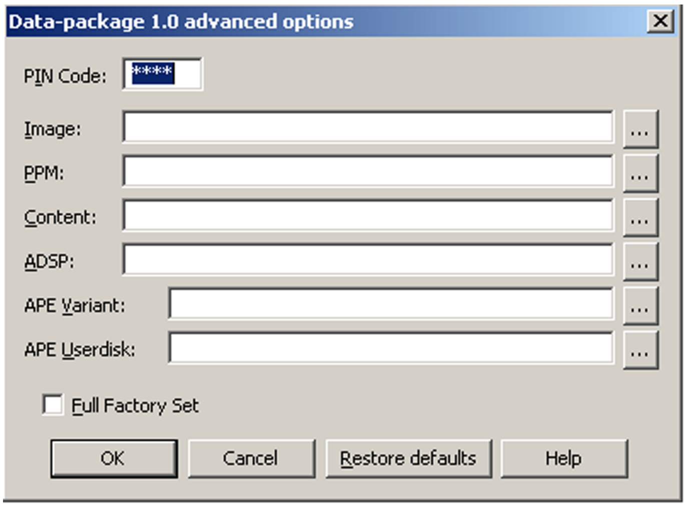

Firmware Update
Product information
Product Code:
SW version:
☐ Dead phone USB flashing
Output
Start
Options
Close
Help
Product Codes available in current Data-Package
OK
Cancel
Help

Flashing Method
○ Restore User Product
● Phone As Manufactured / Refurbish

Product Code	Description	DP ver.
0543065	Russian Black	2.0
0543064	Russian Red	2.0
0543063	Baltian Black	2.0
0543062	Baltian Red	2.0
0543061	Scandinavia Black	2.0
0543060	Scandinavia Red	2.0
0543059	Africa Black	2.0
0543057	Africa Red	2.0
0543056	Euro1 Turkey Black	2.0
0543055	EURO2 - Turkey Red	2.0
0543054	Euro2 Black	2.0
0543053	Euro2 Red	2.0
0543052	Euro1 Alps Black	2.0
0543051	EURO 1 - Alps Red	2.0
0543049	Euro1 France Black	2.0
0543048	EURO 1 - FRANCE Red	2.0
0542586	Euro1 Red	2.0
0534107	Euro1 Black	2.0
0515771	South-Africa Red	2.0
0515770	South-Africa Black	2.0

Code	must be chosen manually, it determines the correct flash files to be used. Please choose the correct product code (can be seen in the phone type label) from the dropdown list.
Flash Type	must be set to **Phone as Manufactured**.

Different flash files can be selected by **Flashing→Firmware Update→Options** as show in the screenshot below.

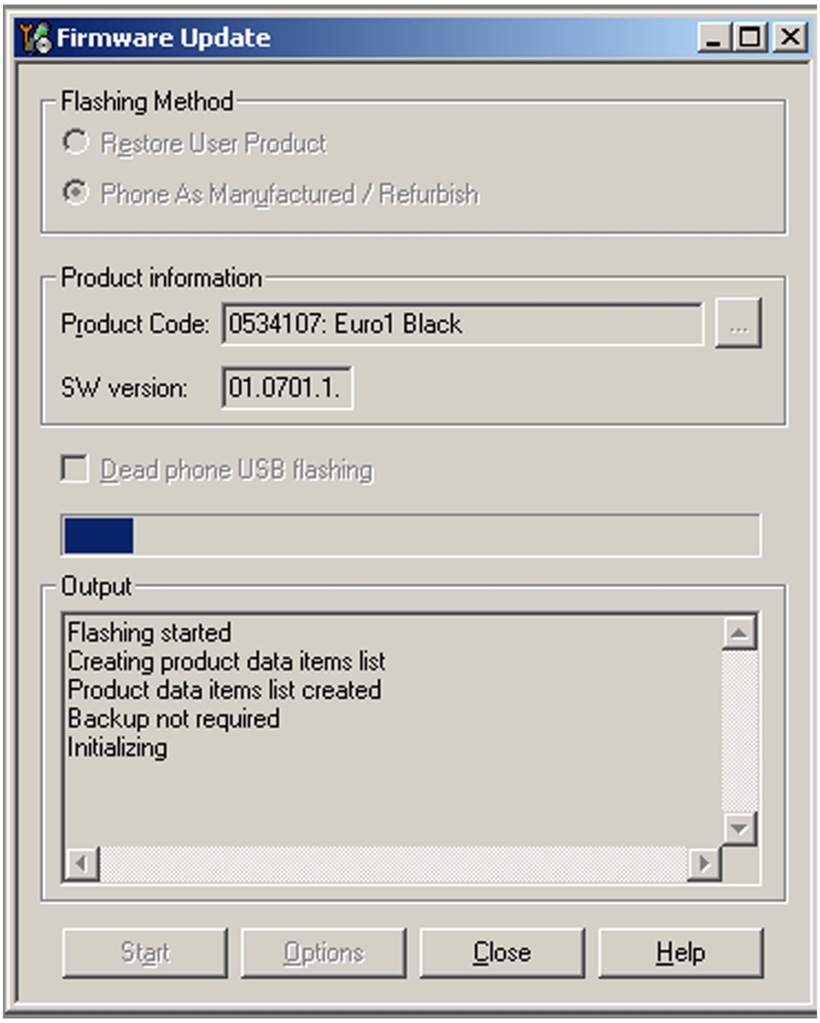

Data-package 1.0 advanced options
Image:
PPM:
Content:
ADSP:
APE Variant:
APE Userdisk:
OK
Cancel
Restore defaults
Help

PIN Code: ****

☐ Full Factory Set

v To continue, click **Start**.

Progress bars and messages on the screen show actions during phone programming, please wait.


Firmware Update
Flashing Method
○ Restore User Product
● Phone As Manufactured / Refurbish
Product information
Start
Options
Close
Help

Product Code: 0534107: Euro1 Black

SW version: 01.0701.1.

☐ Dead phone USB flashing

Output

```
Flashing started
Creating product data items list
Product data items list created
Backup not required
Initializing
```

Programming is completed when *Flashing Completed* message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *Firmware Update* window and then choose **File→Close Product** .

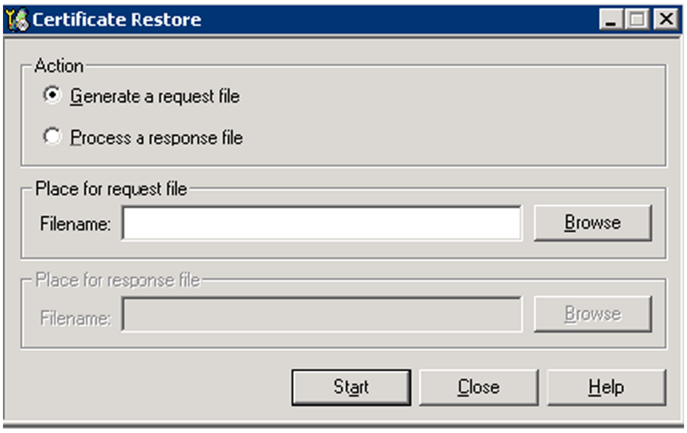
2. Create a *Request* file.

   For this procedure, you must supply +12 V to CU-4 from an external power supply.

   i To connect the phone with *Phoenix*, choose **File→Scan Product** .

   ii Choose **Tools→Certificate Restore** .

iii To choose a location for the request file, click **Browse**.


Certificate Restore
Action
Place for request file
Browse
Place for response file
Browse
Start
Close
Help

Action

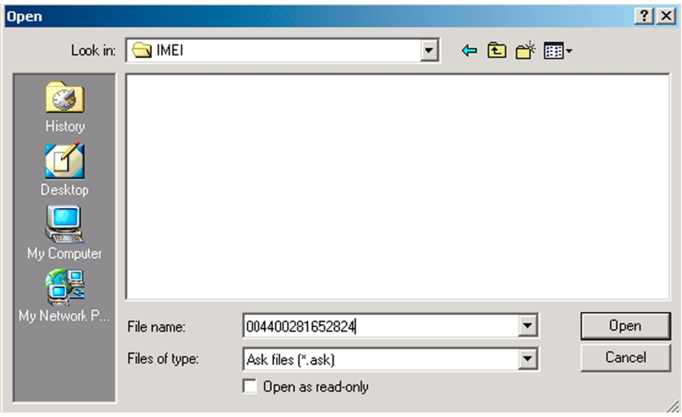
● Generate a request file

○ Process a response file

Place for request file

Filename:

iv Name the file so that you can easily identify it, and click **Open**.


Open
History
Desktop
My Computer
My Network P...
Open
Cancel

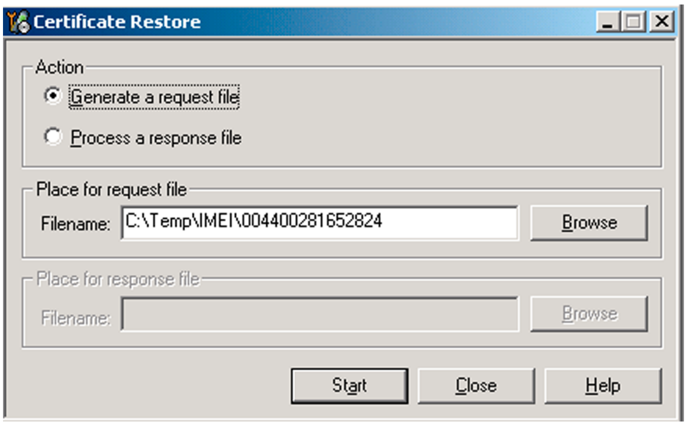
Look in: IMEI

File name: 004400281652824

Files of type: Ask files (*.ask)

☐ Open as read-only

The name of the file and its location are shown.


Certificate Restore
Action
Place for request file
Browse
Place for response file
Browse
Start
Close
Help

Action

● Generate a request file

○ Process a response file

Place for request file

Filename: C:\Temp\IMEI\004400281652824

v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

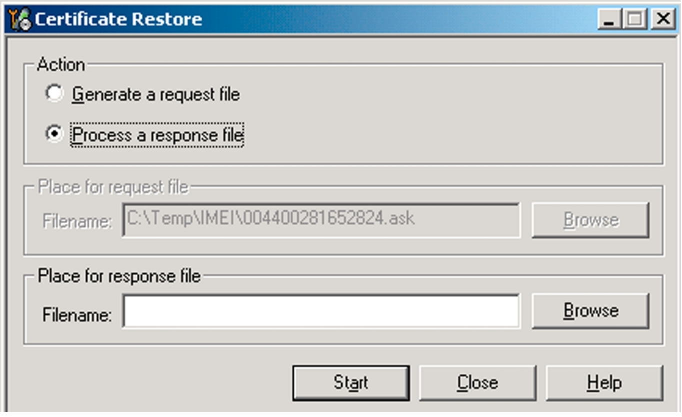
For this procedure, you must supply +12 V to CU-4 from an external power supply.

i Save the reply file sent by Nokia to your computer.

ii Start *Phoenix* service software.

iii Choose **File→Scan Product** .

iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.



Certificate Restore
Start
Close
Help
Browse
Browse

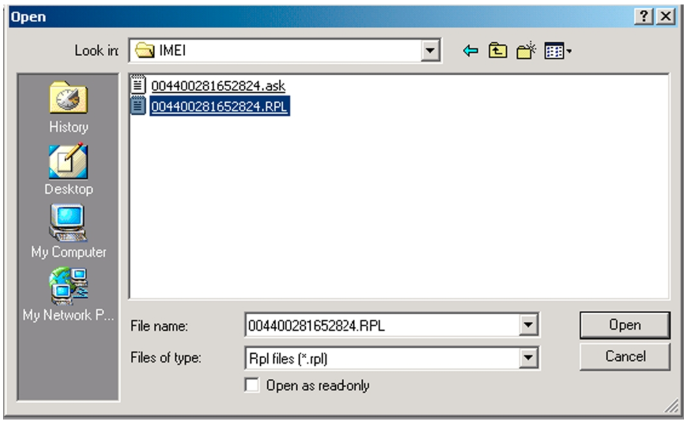
Action
○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file
Filename:

v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.



Open
History
Desktop
My Computer
My Network P...
Open
Cancel

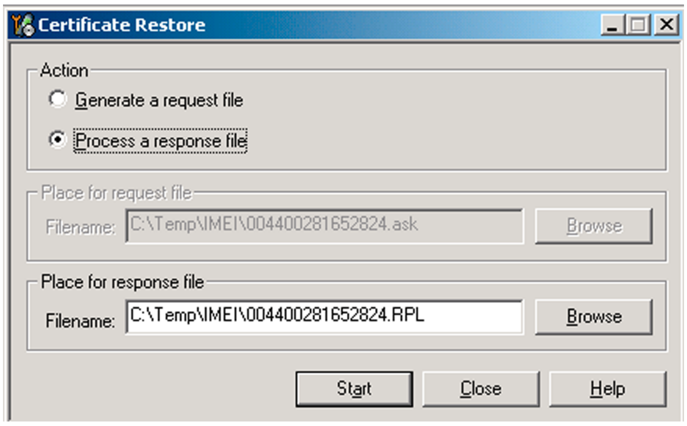
Look in: IMEI

004400281652824.ask
004400281652824.RPL

File name: 004400281652824.RPL
Files of type: Rpl files (*.rpl)
☐ Open as read-only

The name of the file and the path where it is located are shown.

vii To write the file to phone, click **Start**.



Certificate Restore
Start
Close
Help
Browse
Browse

Action
○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file
Filename: C:\Temp\IMEI\004400281652824.RPL

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File**→ **Scan Product.**
4. Choose **Tuning**→**Energy Management.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 5 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

5 — RF troubleshooting

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Table of Contents

General RF troubleshooting 5–5
  Introduction to RF troubleshooting 5–5
  RF key components 5–6
  Non-replaceable RF components 5–7
  General voltage checking 5–8
  Phoenix self tests 5–9
Receiver troubleshooting 5–10
  Introduction to receiver (RX) troubleshooting 5–10
  VCTCXO troubleshooting 5–11
  RX GSM850 troubleshooting 5–12
  RX GSM900 troubleshooting 5–13
  RX GSM1800 troubleshooting 5–14
  RX GSM1900 troubleshooting 5–15
  GSM RX chain activation for manual measurements/GSM RSSI measurement 5–16
  WCDMA receiver troubleshooting 5–17
  WCDMA RX chain activation for manual measurement 5–18
  WCDMA RSSI measurement 5–19
Transmitter troubleshooting 5–19
  General instructions for transmitter (TX) troubleshooting 5–19
  GSM transmitter troubleshooting 5–20
  TX 850/900 troubleshooting 5–22
  TX 1800/1900 troubleshooting 5–23
  Checking antenna functionality 5–24
  WCDMA transmitter troubleshooting 5–26
  WCDMA transmitter troubleshooting flowchart 5–28
RF tunings 5–28
  Introduction to RF tunings 5–28
  Autotuning for BB5 5–29
System mode independent manual tunings 5–30
  RF channel filter calibration 5–30
  PA (power amplifier) detection 5–30
GSM receiver tunings 5–31
  Rx calibration (GSM) 5–31
  Rx band filter response compensation (GSM) 5–34
GSM transmitter tunings 5–37
  Tx IQ tuning (GSM) 5–37
  Tx power level tuning (GSM) 5–39
WCDMA receiver tunings 5–41
  RX calibration (WCDMA) 5–41
WCDMA transmitter tunings 5–44
  Tx AGC & power detector (WCDMA) 5–44
  Tx band response calibration (WCDMA) 5–50
  Tx LO leakage (WCDMA) 5–52

List of Tables

Table 6 Rf channel filter calibration tuning limits 5–30
Table 7 RF tuning limits in Rx calibration 5–33

List of Figures

Figure 51 RF key components - top 5–6
Figure 52 RF key components - bottom 5–7
Figure 53 General voltage checking test points 5–9
Figure 54 WCDMA RX generator settings 5–19
Figure 55 Typical readings 5–21
Figure 56 Bluetooth and main antenna 5–25
Figure 57 Main antenna components 5–26
Figure 58 Phoenix WCDMA TX control window 5–27
Figure 59 WCDMA power window 5–27
Figure 60 Auto tuning concept with CMU200 5–29
Figure 61 Rf channel filter calibration typical values 5–30
Figure 62 Pop-up window for WCDMA2100 5–42
Figure 63 Pop-up window for WCDMA2100 5–44
Figure 64 High burst measurement 5–48

General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Pre-baking

These parts are moisture sensitive and must be pre-baked prior to soldering:

- RFIC N7505
- Front End Module (FEM) N7520
- WCDMA PA N7540

Discrete components

In addition to the key-components, there are a number of discrete components (resistors, inductors and capacitors) for which troubleshooting is done mainly by *visual inspection*.

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

> **Note:** In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

> **Note:** A mobile phone WCDMA transmitter should never be tested with full TX power (only it possible to perform the measurements in a good RF-shielded room). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
>
> **Note:** All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

The scope of this guideline is to enable repairs at key-component level. Some key-components are not accessible, i.e. not replaceable. Please refer to the list of Non-replaceable RF components (page 5–7).

RF key components

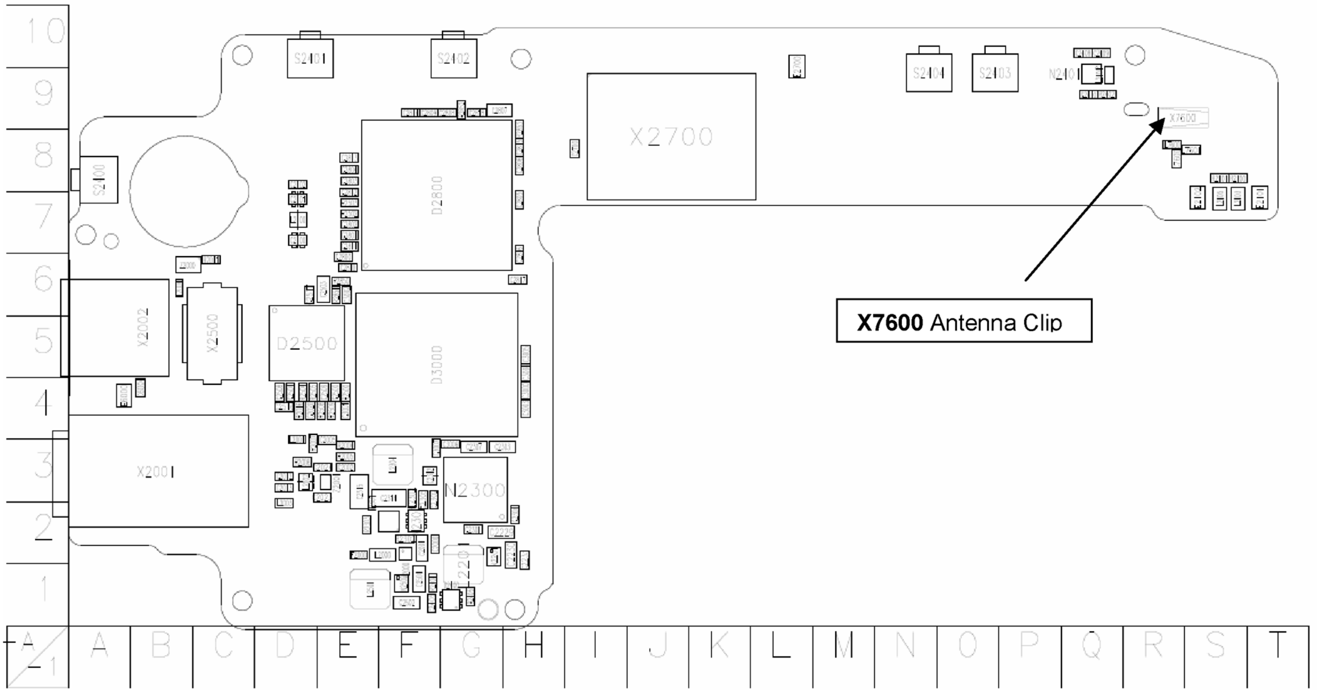

X7600 Antenna Clip
S2101
S2102
S2104
S2103
N2101
X2700
D2800
S2100
X2002
X2500
D2500
D3000
X2001
N2300
10
9
8
7
6
5
4
3
2
1
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T

Figure 51 RF key components - top

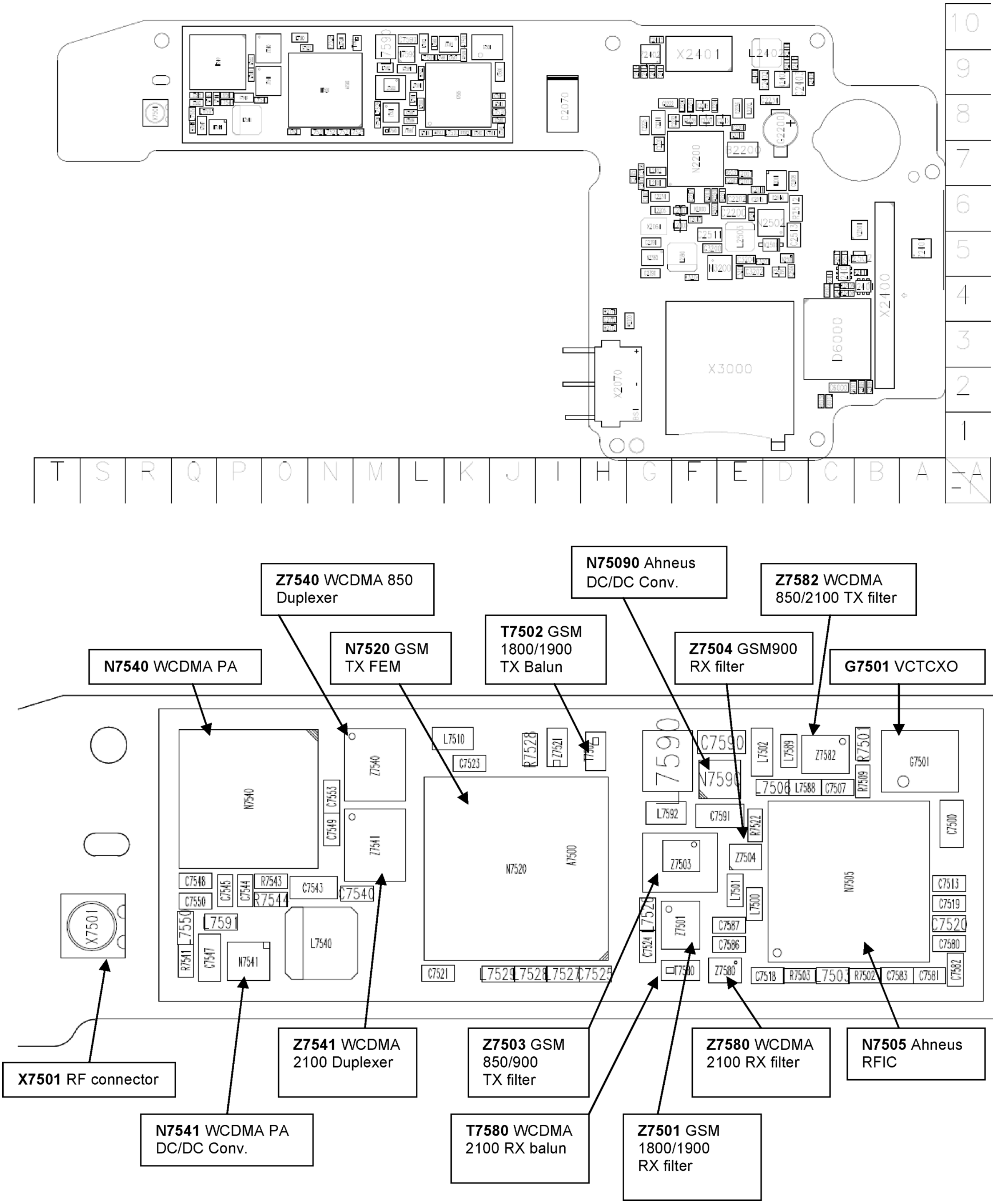
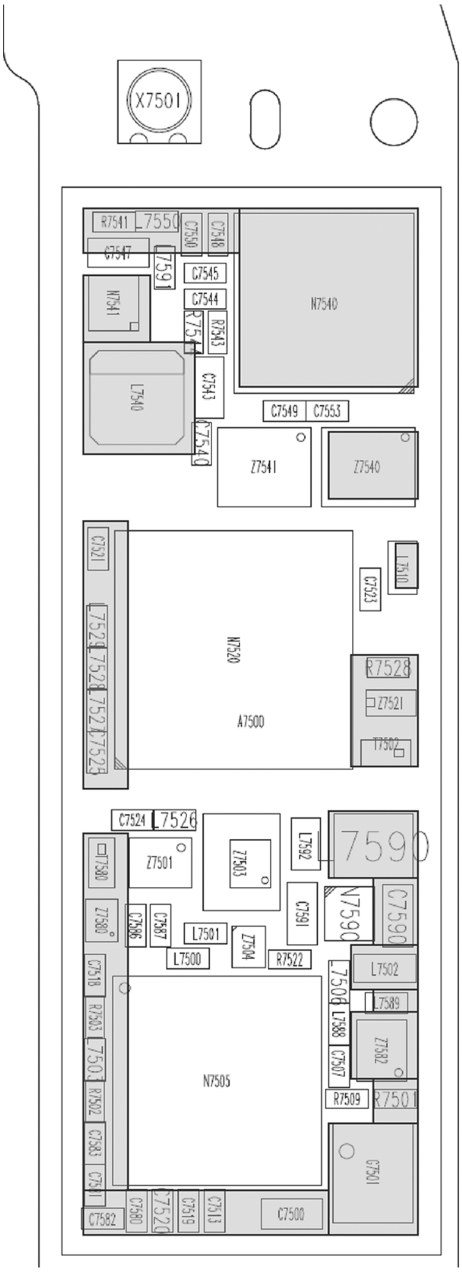

10
9
8
7
6
5
4
3
2
1
T S R Q P O N M L K J I H G F E D C B A
X2401
N2200
X2400
X3000
D6000
X2070
C2070
Z7540 WCDMA 850 Duplexer
N75090 Ahneus DC/DC Conv.
Z7582 WCDMA 850/2100 TX filter
N7540 WCDMA PA
N7520 GSM TX FEM
T7502 GSM 1800/1900 TX Balun
Z7504 GSM900 RX filter
G7501 VCTCXO
X7501 RF connector
Z7541 WCDMA 2100 Duplexer
Z7503 GSM 850/900 TX filter
Z7580 WCDMA 2100 RX filter
N7505 Ahneus RFIC
N7541 WCDMA PA DC/DC Conv.
T7580 WCDMA 2100 RX balun
Z7501 GSM 1800/1900 RX filter

Figure 52 RF key components - bottom

Non-replaceable RF components

The following RF components cannot be replaced because of their location on the PWB:


X7501
R7541
L7550
C7550
C7548
C7547
L7591
C7545
C7544
N7541
L7541
R7543
N7540
L7540
C7543
C7549
C7553
L7540
Z7541
Z7540
C7521
L7510
C7523
N7520
A7500
L7529
L7528
L7527
L7525
R7528
Z7521
T7502
C7524
L7526
L7590
T7580
Z7501
Z7503
L7592
Z7580
C7586
C7587
L7501
L7500
Z7504
C7591
R7522
N7590
C7590
L7502
C7518
L7506
L7589
R7503
L7503
L7588
Z7582
C7507
N7505
R7509
R7501
R7502
C7583
C7581
G7501
C7582
C7580
L7520
C7519
C7513
C7500

Non-replaceable RF components

C7500
C7513
C7518
C7519
C7520
C7521
C7524
C7525
C7548
C7550
C7580
C7581
C7582
C7583
C7590
G7501
L7502
L7506
L7510
L7525
L7527
L7528
L7529
L7530
L7540
L7550
L7589
L7590

N7540
N7541
R7501
R7502
R7503
R7526
R7541
T7502
T7580
Z7540
Z7580
Z7582

General voltage checking

Steps

1. Set up the main board in the module jig. The phone should be in local mode.
2. Check the following:

#	Signal name	Test point	Voltage (all bands)
1	VCTCXO supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	C7590	3.2 V
3	FEM supply	L7510	3.9 V
4	WCDMA PA supply from DC/DC conv	C7543	0 V (1.3 V* when transmitting. Settings as in note below)

#	Signal name	Test point	Voltage (all bands)
5	Vbat at WCDMA PA	C7547	3.9 V
6	Supply input to DC/DC conv	L7592	3.9 V

* With these settings, the result should be 1.3 V.

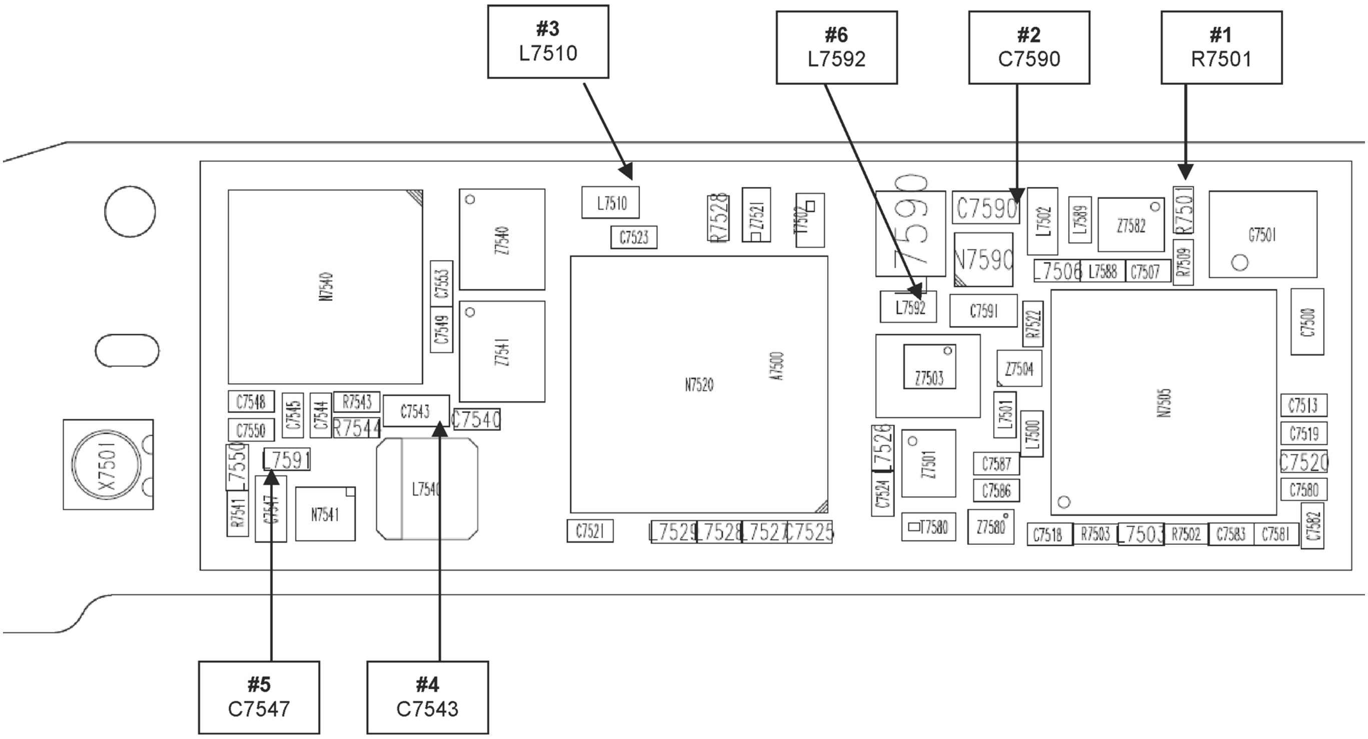

#3
L7510
#6
L7592
#2
C7590
#1
R7501
#5
C7547
#4
C7543
N7540
Z7540
Z7541
N7520
N7505
X7501
G7501
N7590
N7541
L7540
C7590
Z7582
Z7503
Z7504
Z7501

Figure 53 General voltage checking test points

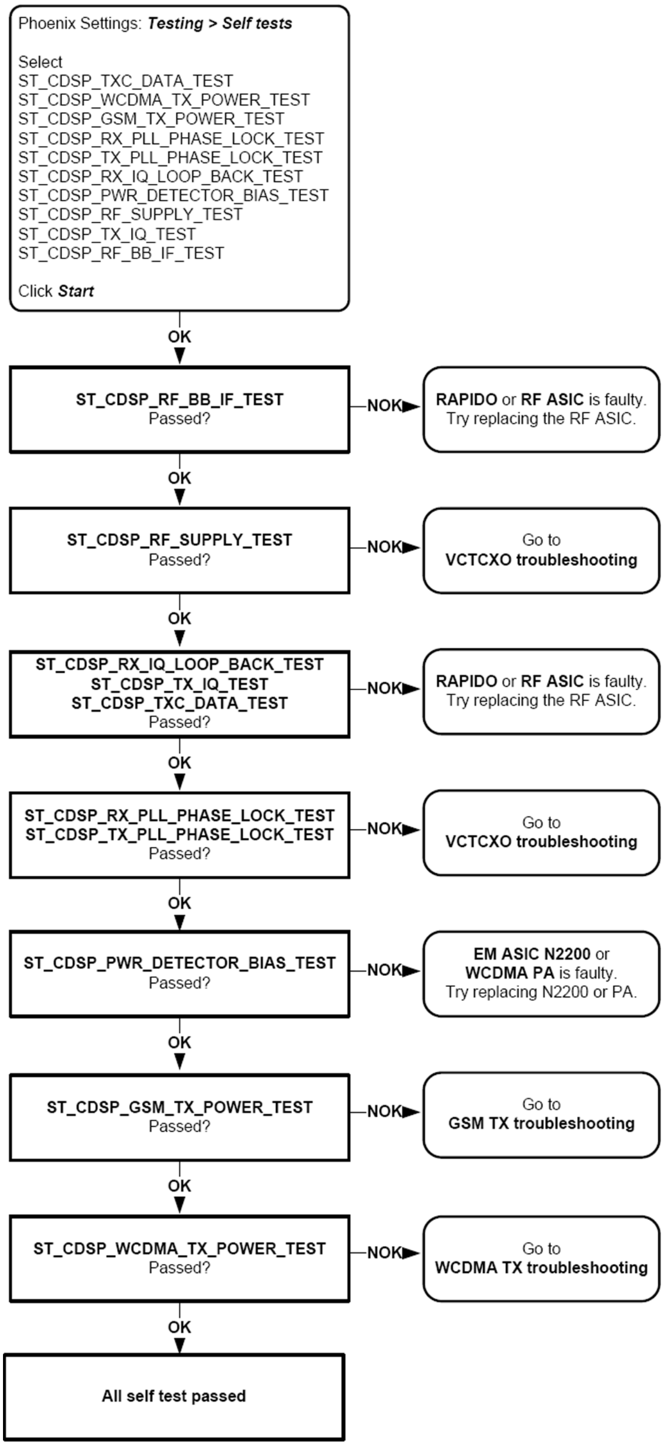
Phoenix self tests

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.* in the baseband troubleshooting section.

Troubleshooting flow


Phoenix Settings: *Testing > Self tests*
Select
ST_CDSP_TXC_DATA_TEST
ST_CDSP_WCDMA_TX_POWER_TEST
ST_CDSP_GSM_TX_POWER_TEST
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_PWR_DETECTOR_BIAS_TEST
ST_CDSP_RF_SUPPLY_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_RF_BB_IF_TEST
Click *Start*
OK
ST_CDSP_RF_BB_IF_TEST Passed?
NOK
RAPIDO or **RF ASIC** is faulty. Try replacing the RF ASIC.
OK
ST_CDSP_RF_SUPPLY_TEST Passed?
NOK
Go to **VCTCXO troubleshooting**
OK
ST_CDSP_RX_IQ_LOOP_BACK_TEST ST_CDSP_TX_IQ_TEST ST_CDSP_TXC_DATA_TEST Passed?
NOK
RAPIDO or **RF ASIC** is faulty. Try replacing the RF ASIC.
OK
ST_CDSP_RX_PLL_PHASE_LOCK_TEST ST_CDSP_TX_PLL_PHASE_LOCK_TEST Passed?
NOK
Go to **VCTCXO troubleshooting**
OK
ST_CDSP_PWR_DETECTOR_BIAS_TEST Passed?
NOK
EM ASIC N2200 or **WCDMA PA** is faulty. Try replacing N2200 or PA.
OK
ST_CDSP_GSM_TX_POWER_TEST Passed?
NOK
Go to **GSM TX troubleshooting**
OK
ST_CDSP_WCDMA_TX_POWER_TEST Passed?
NOK
Go to **WCDMA TX troubleshooting**
OK
All self test passed

Receiver troubleshooting

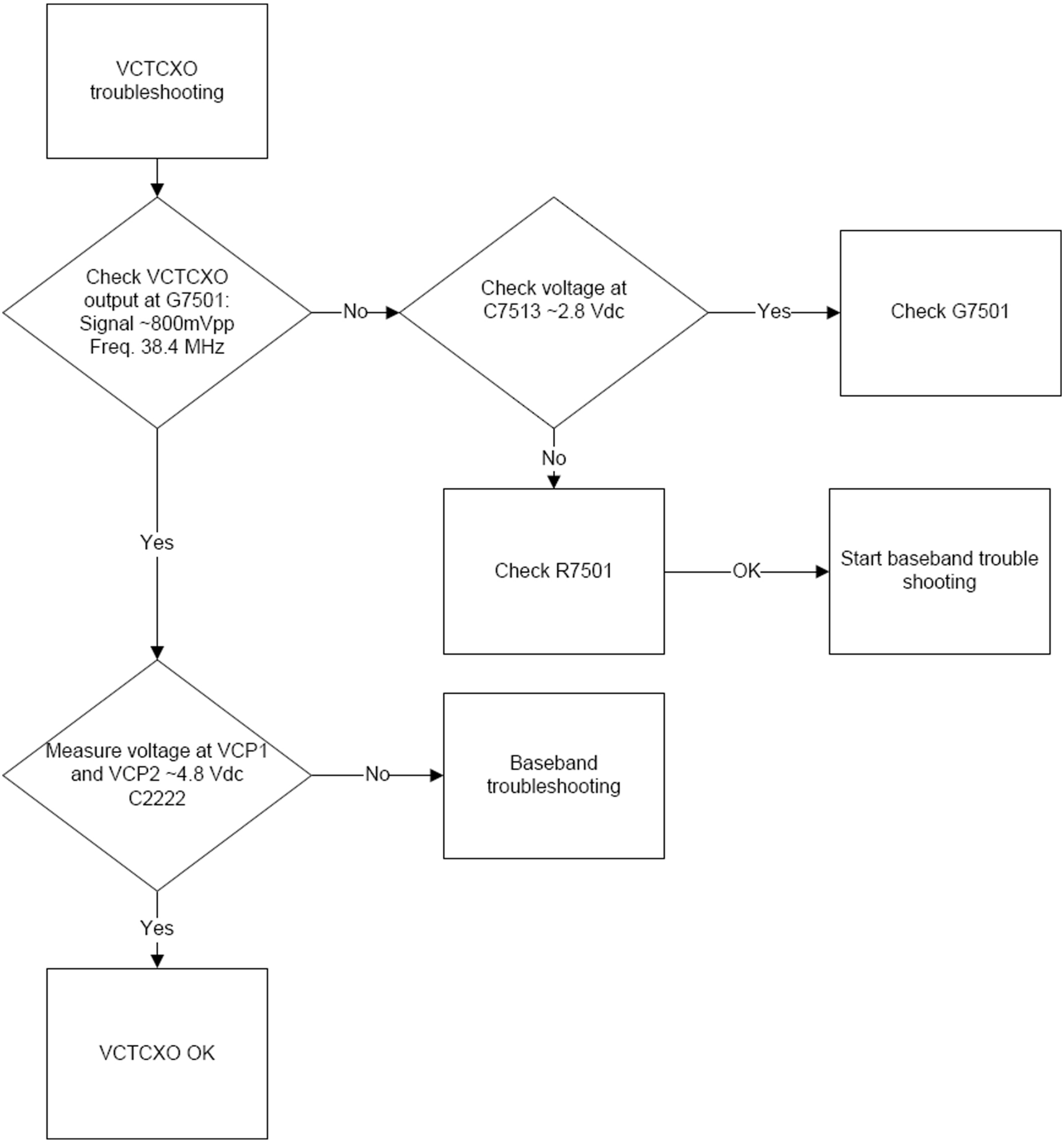
Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see GSM RX chain activation for manual measurements / GSM RSSI measurement (page 5–16). For a similar test in WCDMA mode, see WCDMA RSSI measurement (page 5–19).

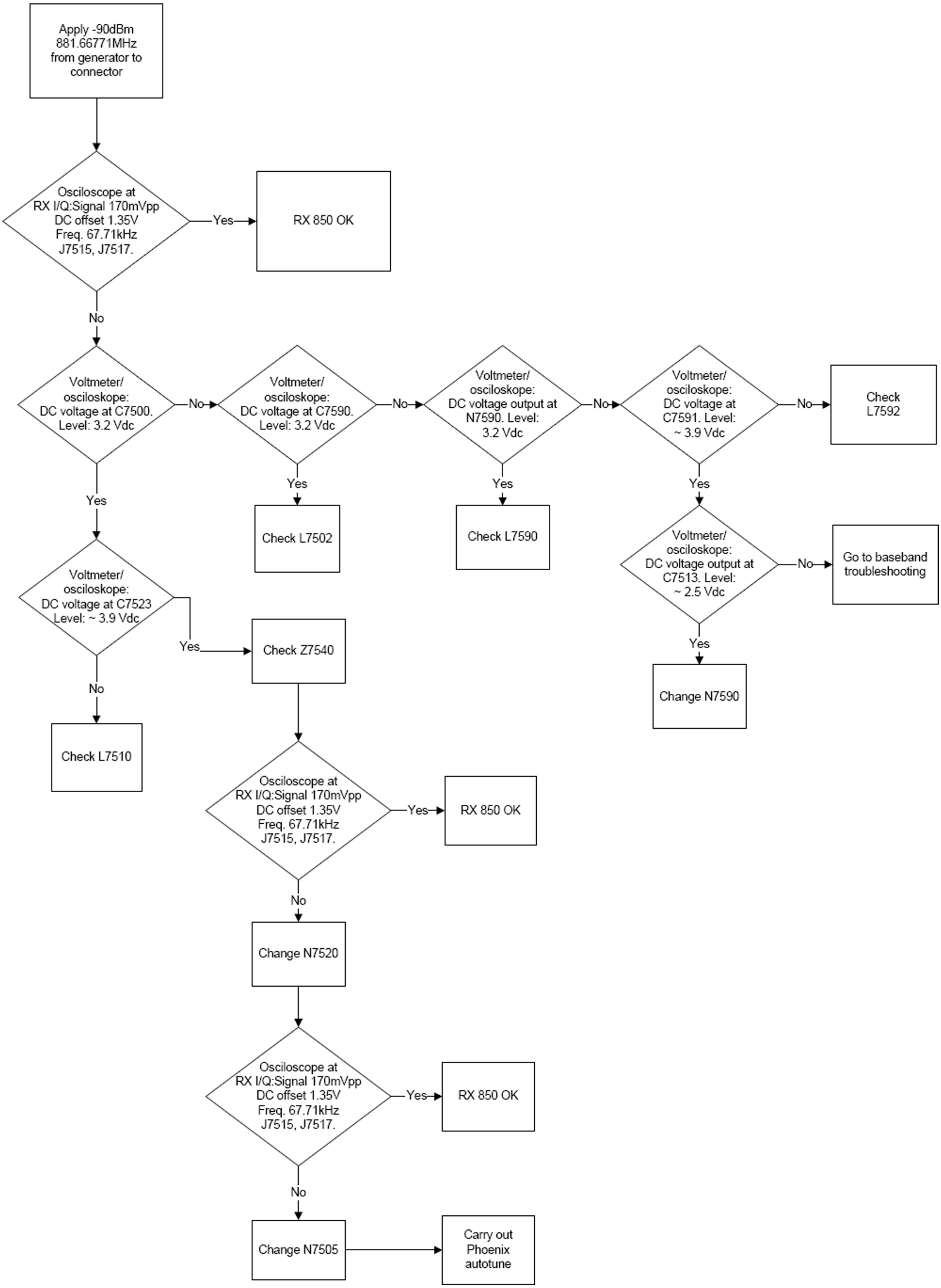
VCTCXO troubleshooting

Troubleshooting flow


VCTCXO troubleshooting
Check VCTCXO output at G7501: Signal ~800mVpp Freq. 38.4 MHz
No
Check voltage at C7513 ~2.8 Vdc
Yes
Check G7501
No
Check R7501
OK
Start baseband trouble shooting
Yes
Measure voltage at VCP1 and VCP2 ~4.8 Vdc C2222
No
Baseband troubleshooting
Yes
VCTCXO OK

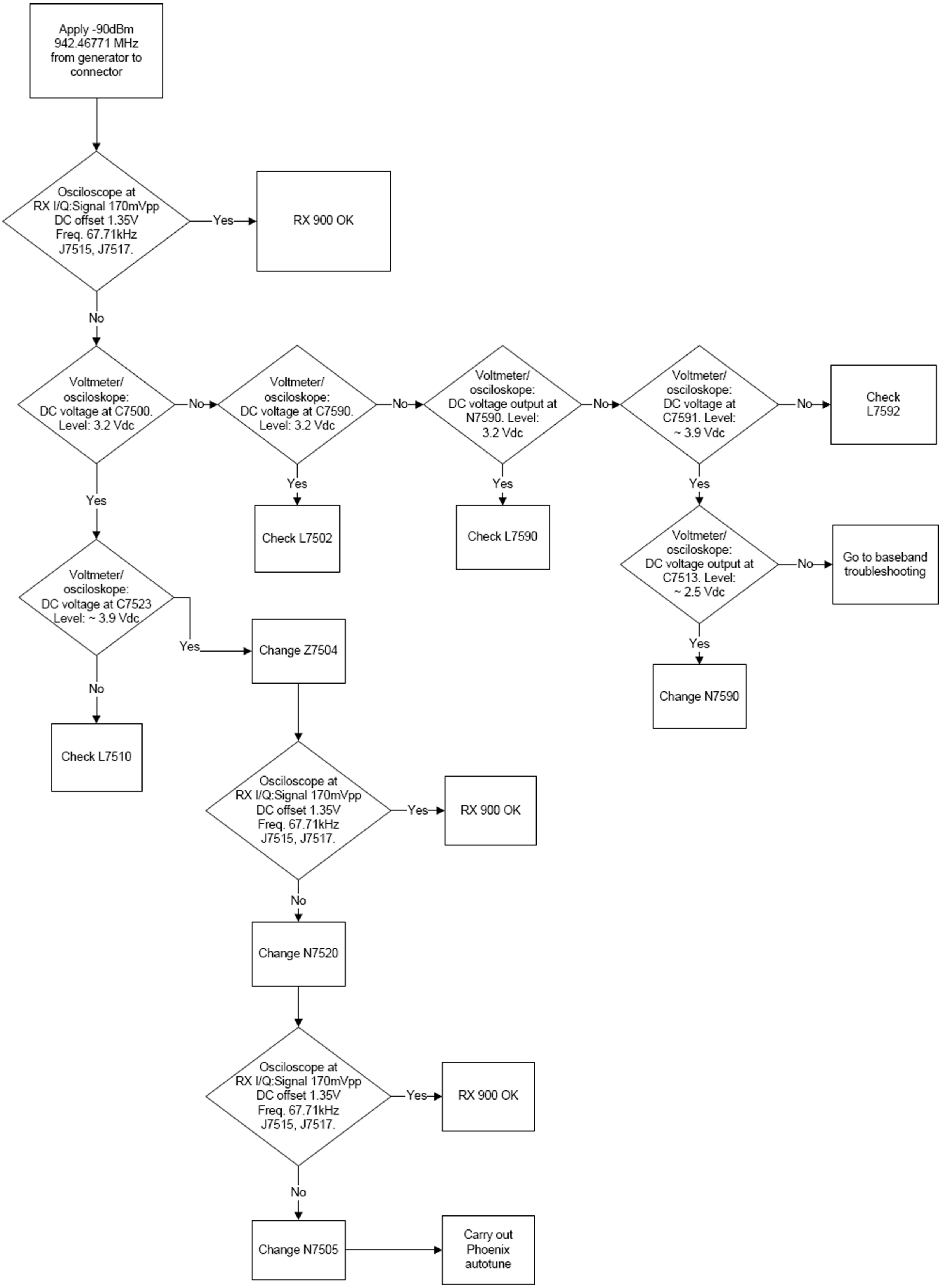
RX GSM850 troubleshooting

Troubleshooting flow


Apply -90dBm 881.66771MHz from generator to connector
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 850 OK
No
Voltmeter/ osciloskope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ osciloskope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Voltmeter/ osciloskope: DC voltage at C7523 Level: ~ 3.9 Vdc
Yes
Check Z7540
No
Check L7510
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 850 OK
No
Change N7520
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 850 OK
No
Change N7505
Carry out Phoenix autotune

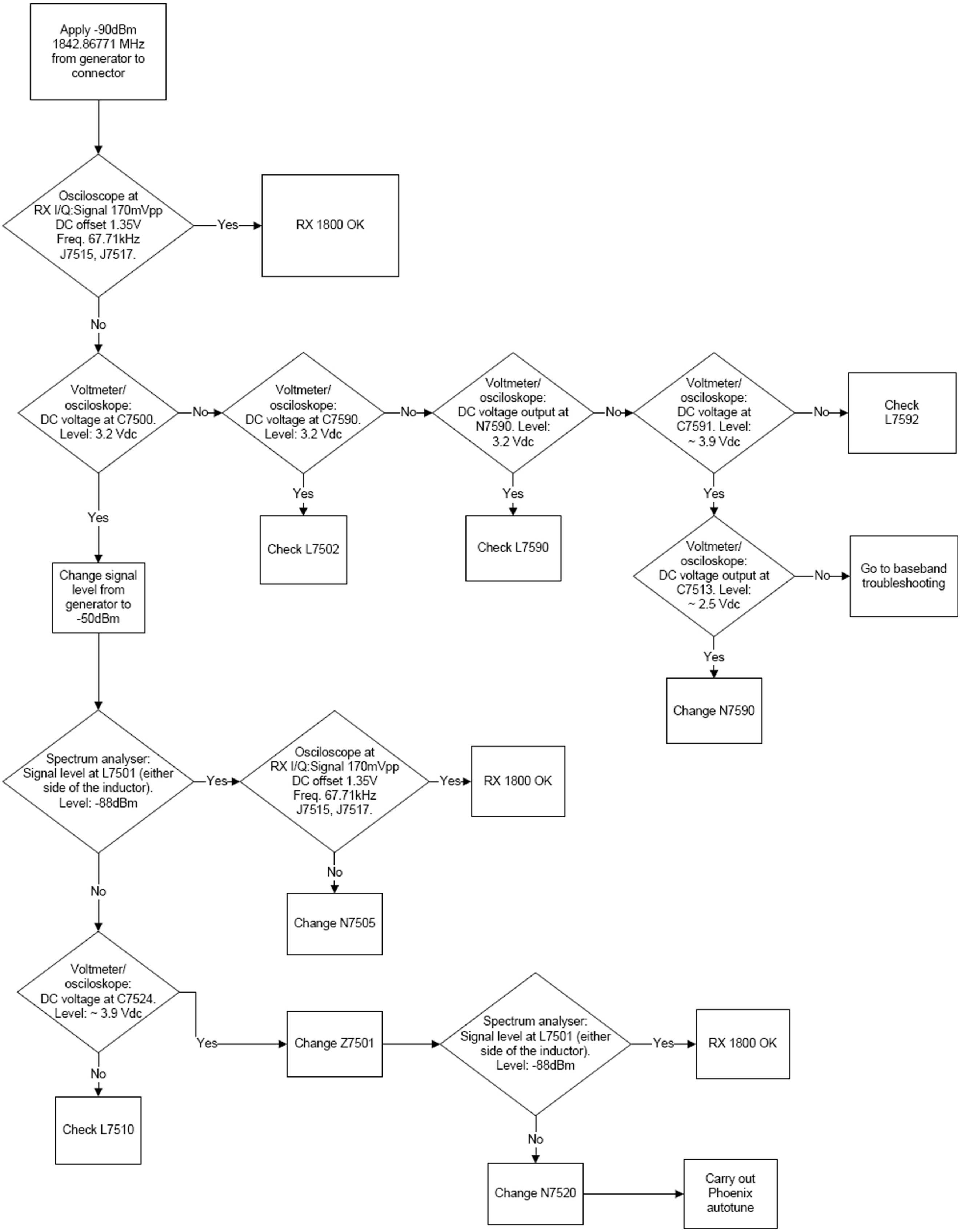
RX GSM900 troubleshooting

Troubleshooting flow


Apply -90dBm
942.46771 MHz
from generator to
connector
Osciloscope at
RX I/Q:Signal 170mVpp
DC offset 1.35V
Freq. 67.71kHz
J7515, J7517.
Yes
RX 900 OK
No
Voltmeter/
osciloskope:
DC voltage at C7500.
Level: 3.2 Vdc
No
Voltmeter/
osciloskope:
DC voltage at C7590.
Level: 3.2 Vdc
No
Voltmeter/
osciloskope:
DC voltage output at
N7590. Level:
3.2 Vdc
No
Voltmeter/
osciloskope:
DC voltage at
C7591. Level:
~ 3.9 Vdc
No
Check
L7592
Yes
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/
osciloskope:
DC voltage at C7523
Level: ~ 3.9 Vdc
Yes
Change Z7504
No
Check L7510
Voltmeter/
osciloskope:
DC voltage output at
C7513. Level:
~ 2.5 Vdc
No
Go to baseband
troubleshooting
Yes
Change N7590
Osciloscope at
RX I/Q:Signal 170mVpp
DC offset 1.35V
Freq. 67.71kHz
J7515, J7517.
Yes
RX 900 OK
No
Change N7520
Osciloscope at
RX I/Q:Signal 170mVpp
DC offset 1.35V
Freq. 67.71kHz
J7515, J7517.
Yes
RX 900 OK
No
Change N7505
Carry out
Phoenix
autotune

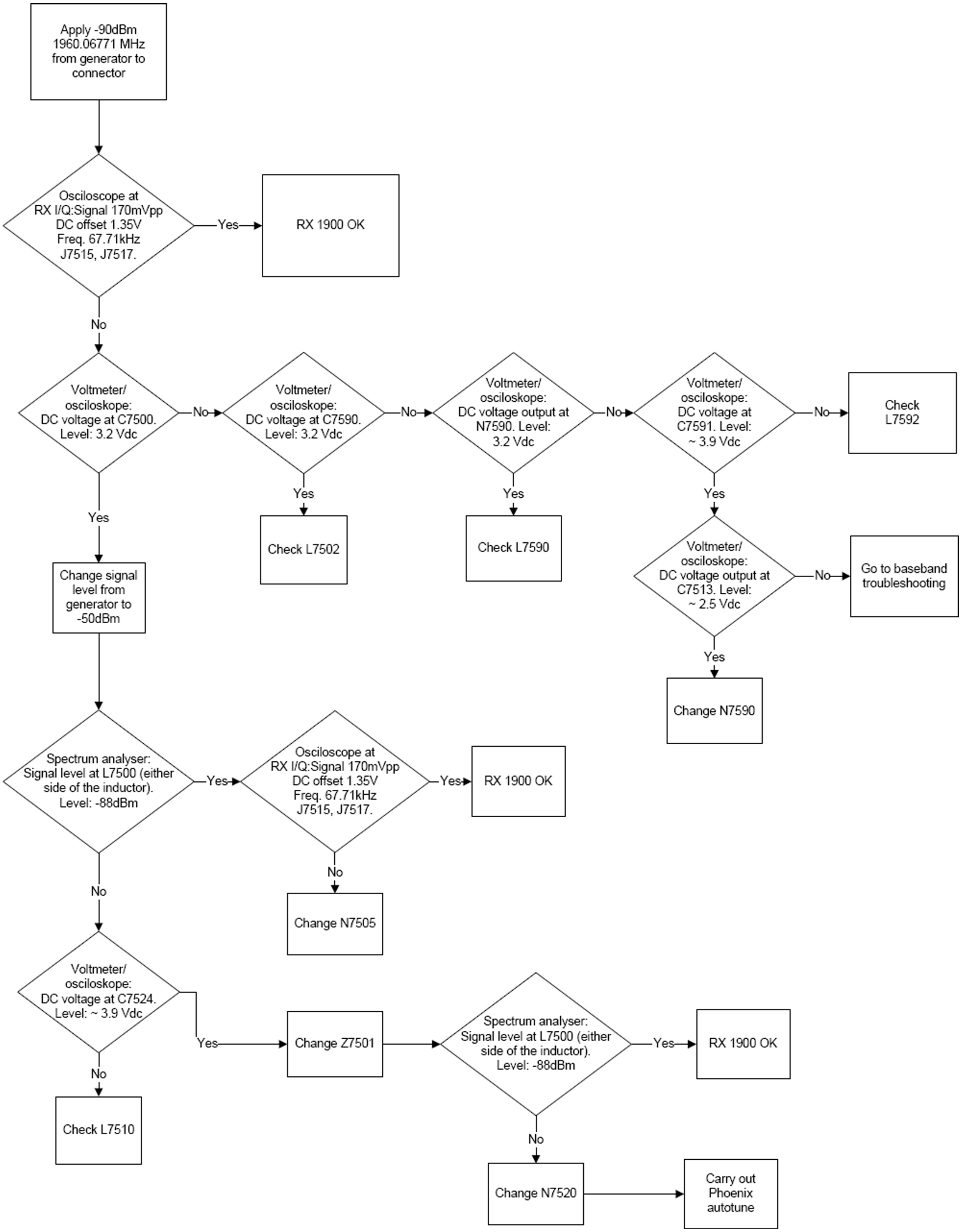
RX GSM1800 troubleshooting

Troubleshooting flow


Apply -90dBm 1842.86771 MHz from generator to connector
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 1800 OK
No
Voltmeter/ osciloskope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ osciloskope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Change signal level from generator to -50dBm
Spectrum analyser: Signal level at L7501 (either side of the inductor). Level: -88dBm
Yes
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 1800 OK
No
Change N7505
No
Voltmeter/ osciloskope: DC voltage at C7524. Level: ~ 3.9 Vdc
Yes
Change Z7501
Spectrum analyser: Signal level at L7501 (either side of the inductor). Level: -88dBm
Yes
RX 1800 OK
No
Check L7510
No
Change N7520
Carry out Phoenix autotune

RX GSM1900 troubleshooting

Troubleshooting flow


Apply -90dBm 1960.06771 MHz from generator to connector
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 1900 OK
No
Voltmeter/ osciloskope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ osciloskope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Change signal level from generator to -50dBm
Spectrum analyser: Signal level at L7500 (either side of the inductor). Level: -88dBm
Yes
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 1900 OK
No
Change N7505
No
Voltmeter/ osciloskope: DC voltage at C7524. Level: ~ 3.9 Vdc
Yes
Change Z7501
Spectrum analyser: Signal level at L7500 (either side of the inductor). Level: -88dBm
Yes
RX 1900 OK
No
Check L7510
No
Change N7520
Carry out Phoenix autotune

GSM RX chain activation for manual measurements/GSM RSSI measurement

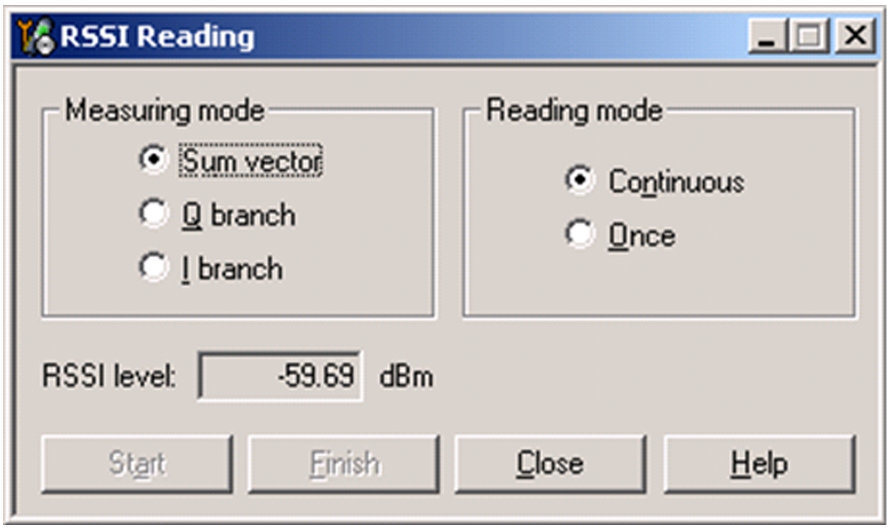
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771MHz (67.71kHz offset) at -60dBm	942.46771MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.06771MHz (67.71kHz offset) at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)



Measuring mode: ● Sum vector ○ Q branch ○ I branch

Reading mode: ● Continuous ○ Once

RSSI level: -59.69 dBm

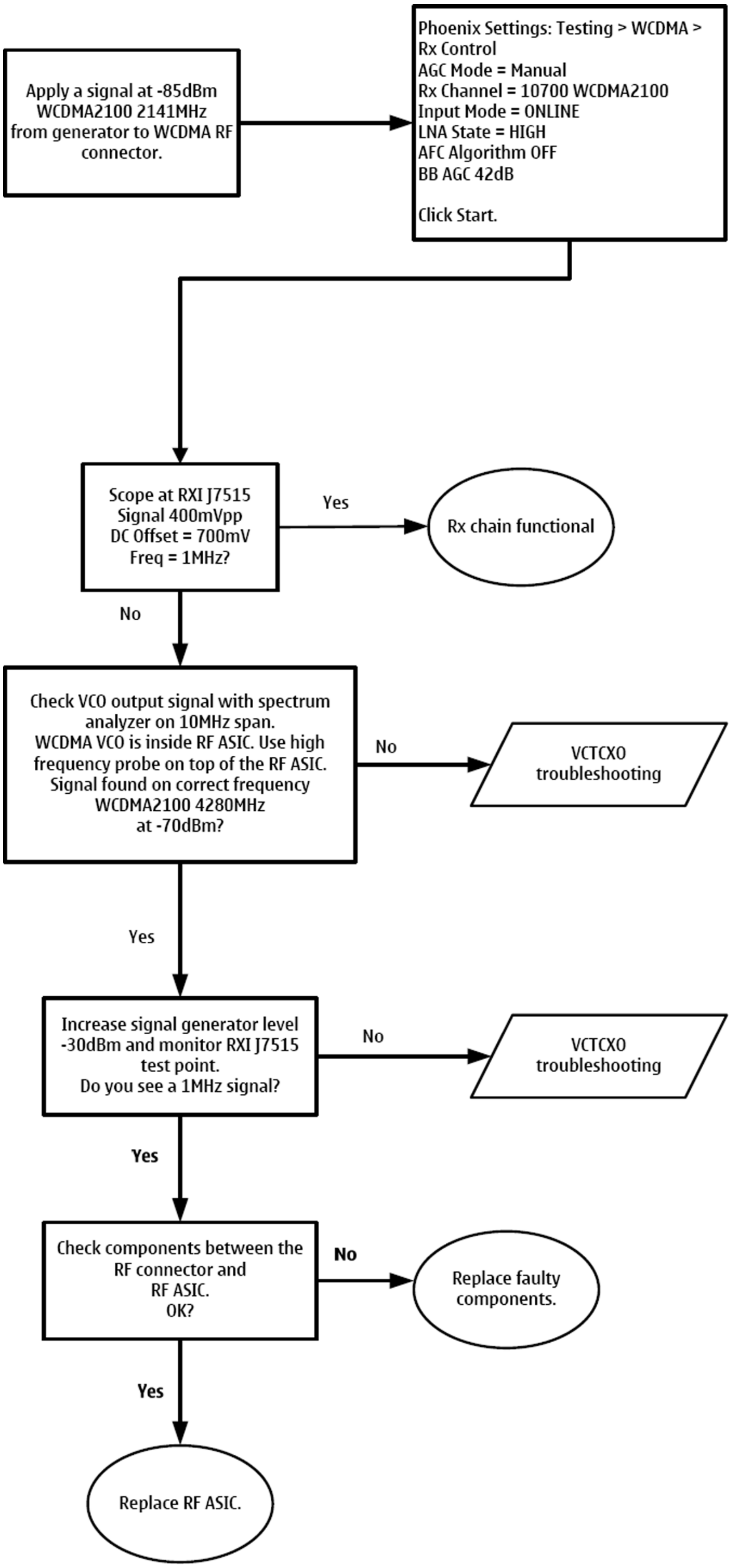
Results

The reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

WCDMA receiver troubleshooting

Troubleshooting flow


Apply a signal at -85dBm WCDMA2100 2141MHz from generator to WCDMA RF connector.
Phoenix Settings: Testing > WCDMA > Rx Control
AGC Mode = Manual
Rx Channel = 10700 WCDMA2100
Input Mode = ONLINE
LNA State = HIGH
AFC Algorithm OFF
BB AGC 42dB
Click Start.
Scope at RXI J7515 Signal 400mVpp DC Offset = 700mV Freq = 1MHz?
Yes
Rx chain functional
No
Check VCO output signal with spectrum analyzer on 10MHz span. WCDMA VCO is inside RF ASIC. Use high frequency probe on top of the RF ASIC. Signal found on correct frequency WCDMA2100 4280MHz at -70dBm?
No
VCTCXO troubleshooting
Yes
Increase signal generator level -30dBm and monitor RXI J7515 test point. Do you see a 1MHz signal?
No
VCTCXO troubleshooting
Yes
Check components between the RF connector and RF ASIC. OK?
No
Replace faulty components.
Yes
Replace RF ASIC.

WCDMA RX chain activation for manual measurement

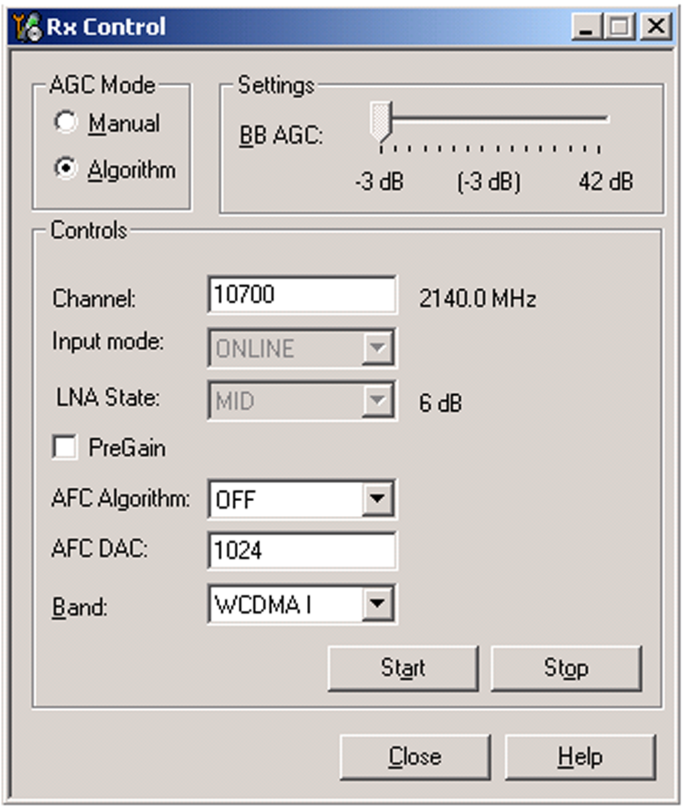
Prerequisites

Make the following settings in Phoenix service software:

Setting	WCDMA2100
Phoenix Channel	10700
Signal generator to antenna connector	2141.0 MHz

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:



AGC Mode

○ Manual

● Algorithm

Settings

BB AGC: -3 dB (-3 dB) 42 dB

Controls

Channel: 10700 2140.0 MHz

Input mode: ONLINE

LNA State: MID 6 dB

☐ PreGain

AFC Algorithm: OFF

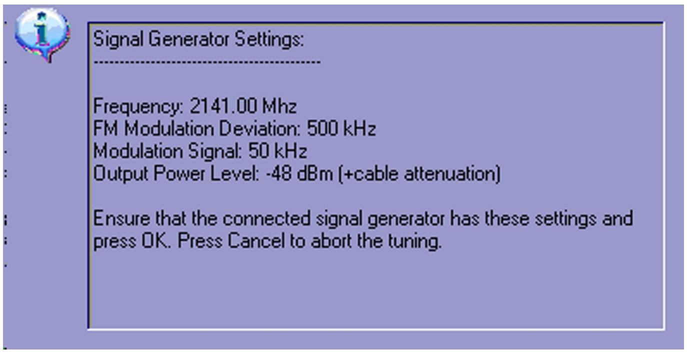
AFC DAC: 1024

Band: WCDMA I

3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.
4. Set the following RF generator settings:



Signal Generator Settings:

Frequency: 2141.00 Mhz
FM Modulation Deviation: 500 kHz
Modulation Signal: 50 kHz
Output Power Level: -48 dBm (+cable attenuation)

Ensure that the connected signal generator has these settings and press OK. Press Cancel to abort the tuning.

Figure 54 WCDMA RX generator settings

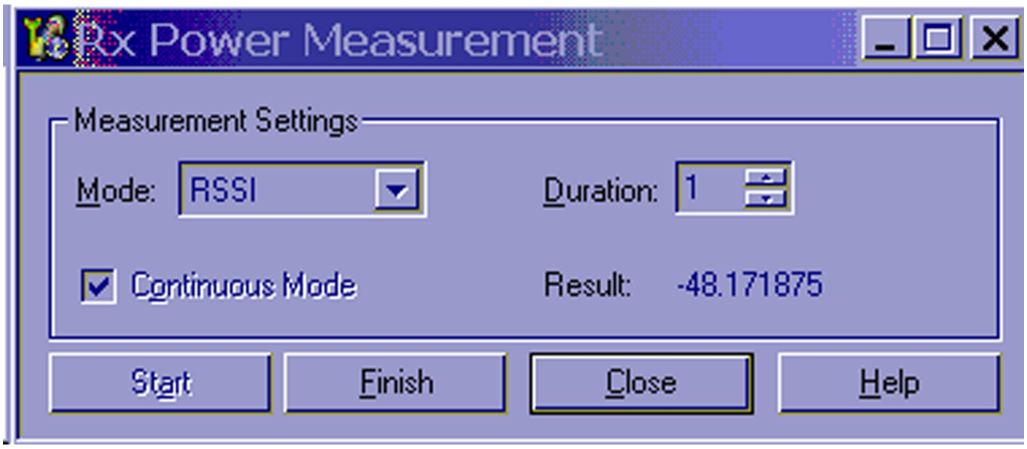
WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to WCDMA RX chain activation (page 5–18).

Steps

1. From the Phoenix testing menu, select **WCDMA→RX Power measurement**
2. In the RX Power measurement window, select:
   - Mode: RSSI
   - Continuous mode



Rx Power Measurement

Measurement Settings

Mode: RSSI

Duration: 1

☑ Continuous Mode

Result: -48.171875

3. Click **Start** to perform the measurement.

Transmitter troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”; in WCDMA transmitter testing the best tool is “TX Control”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production

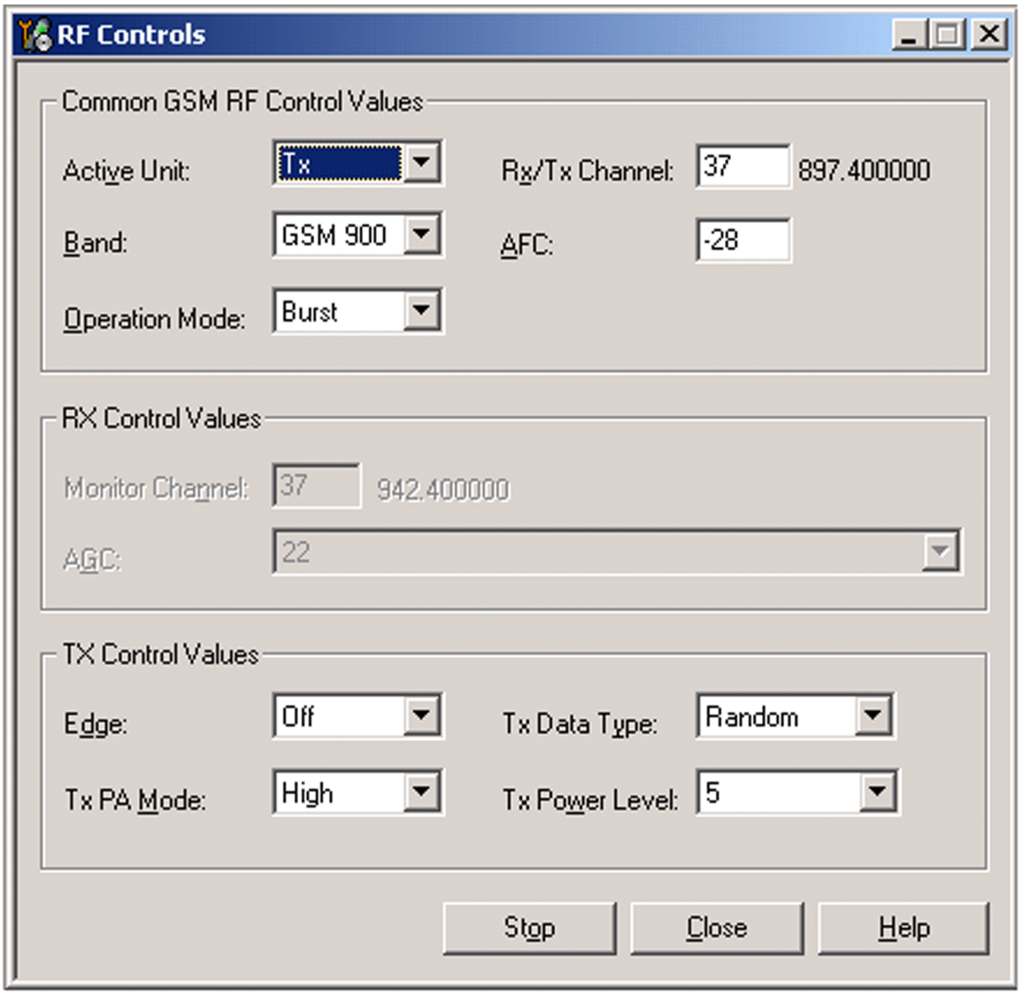
Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM or WCDMA Power amplifier (PA) may be damaged.

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).

   Use the following settings:



Common GSM RF Control Values

Active Unit: Tx
Rx/Tx Channel: 37 897.400000
Band: GSM 900
AFC: -28
Operation Mode: Burst

RX Control Values

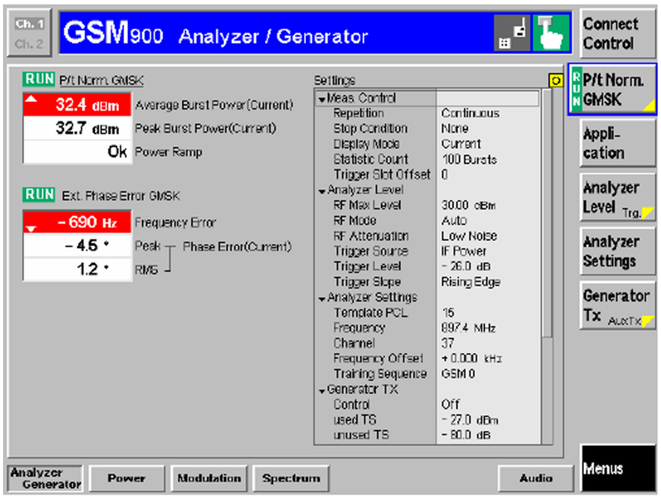
Monitor Channel: 37 942.400000
AGC: 22

TX Control Values

Edge: Off
Tx Data Type: Random
Tx PA Mode: High
Tx Power Level: 5

3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

Analyser settings



GSM900 Analyzer / Generator

RUN P/t Norm. GMSK

32.4 dBm Average Burst Power(Current)
32.7 dBm Peak Burst Power(Current)
Ok Power Ramp

RUN Ext. Phase Error GMSK

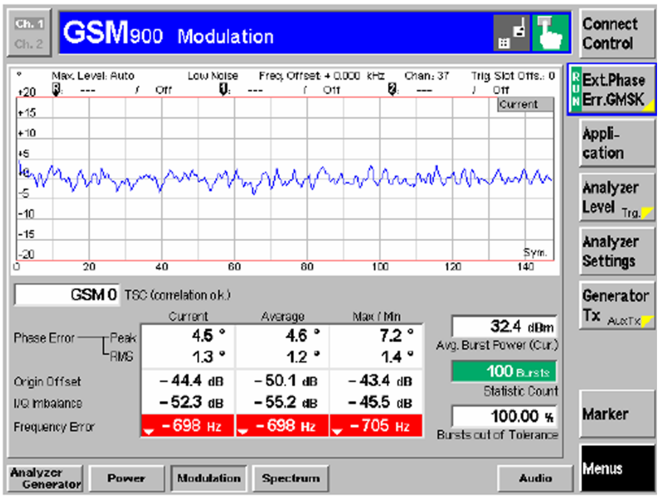
−690 Hz Frequency Error
−4.5 ° Peak Phase Error(Current)
1.2 ° RMS

Settings

Meas. Control	
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Trigger Slot Offset	0
Analyzer Level	
RF Max Level	30.00 dBm
RF Mode	Auto
RF Attenuation	Low Noise
Trigger Source	IF Power
Trigger Level	−26.0 dB
Trigger Slope	Rising Edge
Analyzer Settings	
Template PCL	15
Frequency	897.4 MHz
Channel	37
Frequency Offset	+0.000 kHz
Training Sequence	GSM 0
Generator TX	
Control	Off
used TS	−27.0 dBm
unused TS	−80.0 dB

Ch. 1
Ch. 2
Connect Control
P/t Norm. GMSK
Appli-cation
Analyzer Level Trg.
Analyzer Settings
Generator Tx AuxTx
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

Phase error



GSM900 Modulation

Max. Level: Auto Low Noise Freq. Offset: +0.000 kHz Chan.: 37 Trig. Slot Offs.: 0

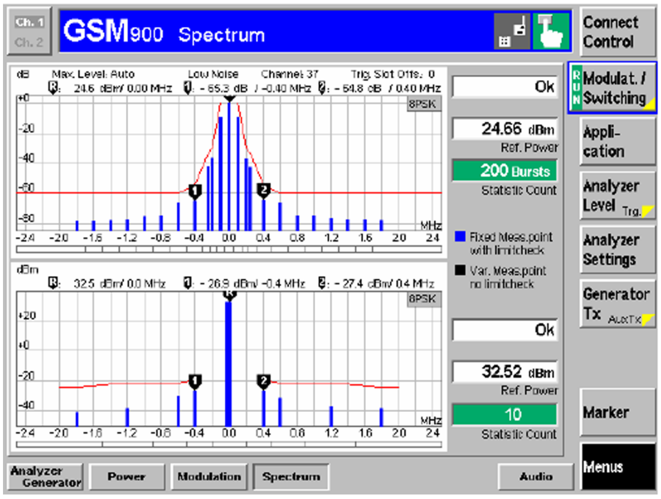
GSM 0 TSC (correlation o.k.)

		Current	Average	Max / Min
Phase Error	Peak	4.5 °	4.6 °	7.2 °
	RMS	1.3 °	1.2 °	1.4 °
Origin Offset		−44.4 dB	−50.1 dB	−43.4 dB
I/Q Imbalance		−52.3 dB	−55.2 dB	−45.5 dB
Frequency Error		−698 Hz	−698 Hz	−705 Hz

32.4 dBm Avg. Burst Power (Cur.)
100 Bursts Statistic Count
100.00 % Bursts out of Tolerance

Ch. 1
Ch. 2
°
+20
+15
+10
+5
0
-5
-10
-15
-20
Current
Sym.
0
20
40
60
80
100
120
140
Connect Control
Ext.Phase Err.GMSK
Appli-cation
Analyzer Level Trg.
Analyzer Settings
Generator Tx AuxTx
Marker
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

Modulation/Switching spectrum



GSM900 Spectrum

Max. Level: Auto Low Noise Channel: 37 Trig. Slot Offs.: 0
R: 24.6 dBm/ 0.00 MHz 1: −65.3 dB / −0.40 MHz 2: −64.8 dB / 0.40 MHz

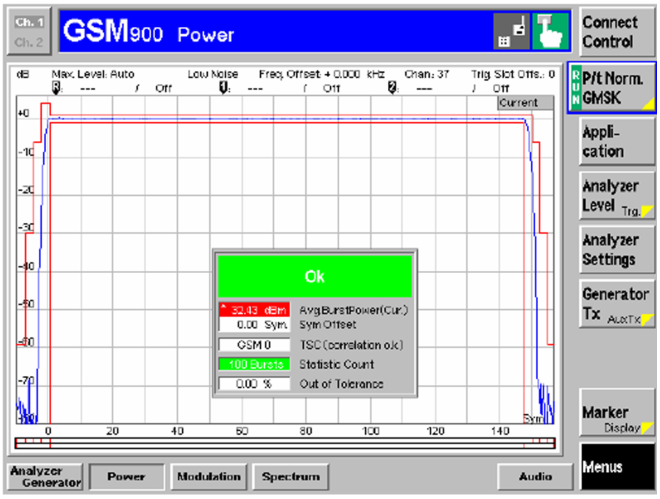
Ok
24.66 dBm Ref. Power
200 Bursts Statistic Count

R: 32.5 dBm/ 0.0 MHz 1: −26.9 dBm/ −0.4 MHz 2: −27.4 dBm/ 0.4 MHz

Ok
32.52 dBm Ref. Power
10 Statistic Count

Ch. 1
Ch. 2
dB
+0
-20
-40
-60
-80
8PSK
MHz
-2.4
-2.0
-1.6
-1.2
-0.8
-0.4
0.0
0.4
0.8
1.2
1.6
2.0
2.4
dBm
+20
+0
-20
-40
Fixed Meas.point with limitcheck
Var. Meas.point no limitcheck
Connect Control
Modulat. / Switching
Appli-cation
Analyzer Level Trg.
Analyzer Settings
Generator Tx AuxTx
Marker
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

Power/Burst



GSM900 Power

Max. Level: Auto Low Noise Freq. Offset: +0.000 kHz Chan.: 37 Trig. Slot Offs.: 0

Ok
32.43 dBm AvgBurstPower(Cur.)
0.00 Sym. Sym Offset
GSM 0 TSC (correlation o.k.)
100 Bursts Statistic Count
0.00 % Out of Tolerance

Ch. 1
Ch. 2
dB
+0
-10
-20
-30
-40
-50
-60
-70
Current
Sym.
0
20
40
60
80
100
120
140
Connect Control
P/t Norm. GMSK
Appli-cation
Analyzer Level Trg.
Analyzer Settings
Generator Tx AuxTx
Marker Display
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

Figure 55 Typical readings

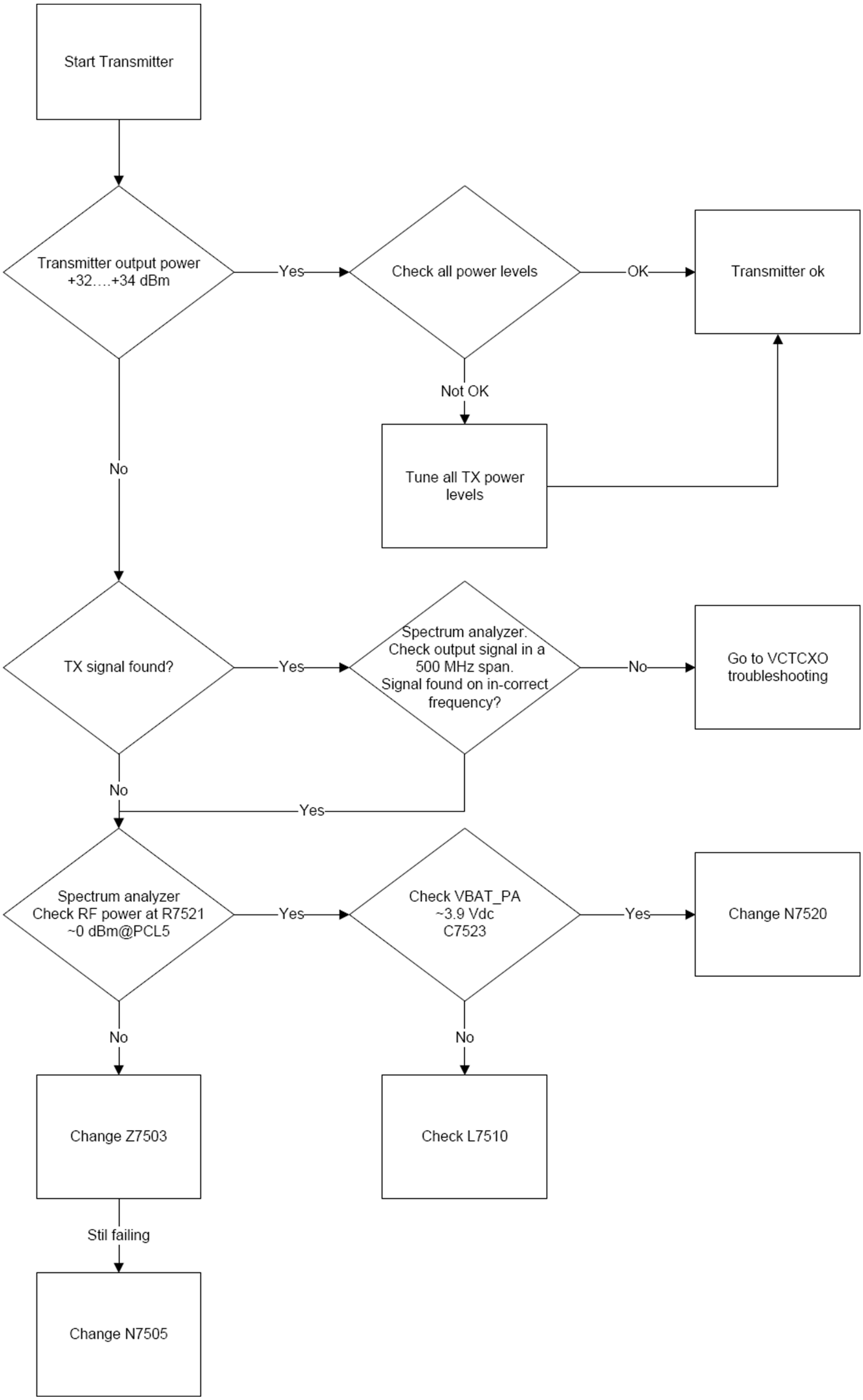
4. Change the power level (RF controls) and make sure the power reading follows accordingly.

Next actions

You can troubleshoot the GSM transmitter for each GSM band separately, one band at a time. If you want to troubleshoot GSM850, GSM1800 or GSM1900, change the band with the RF controls and set the communication analyser accordingly.

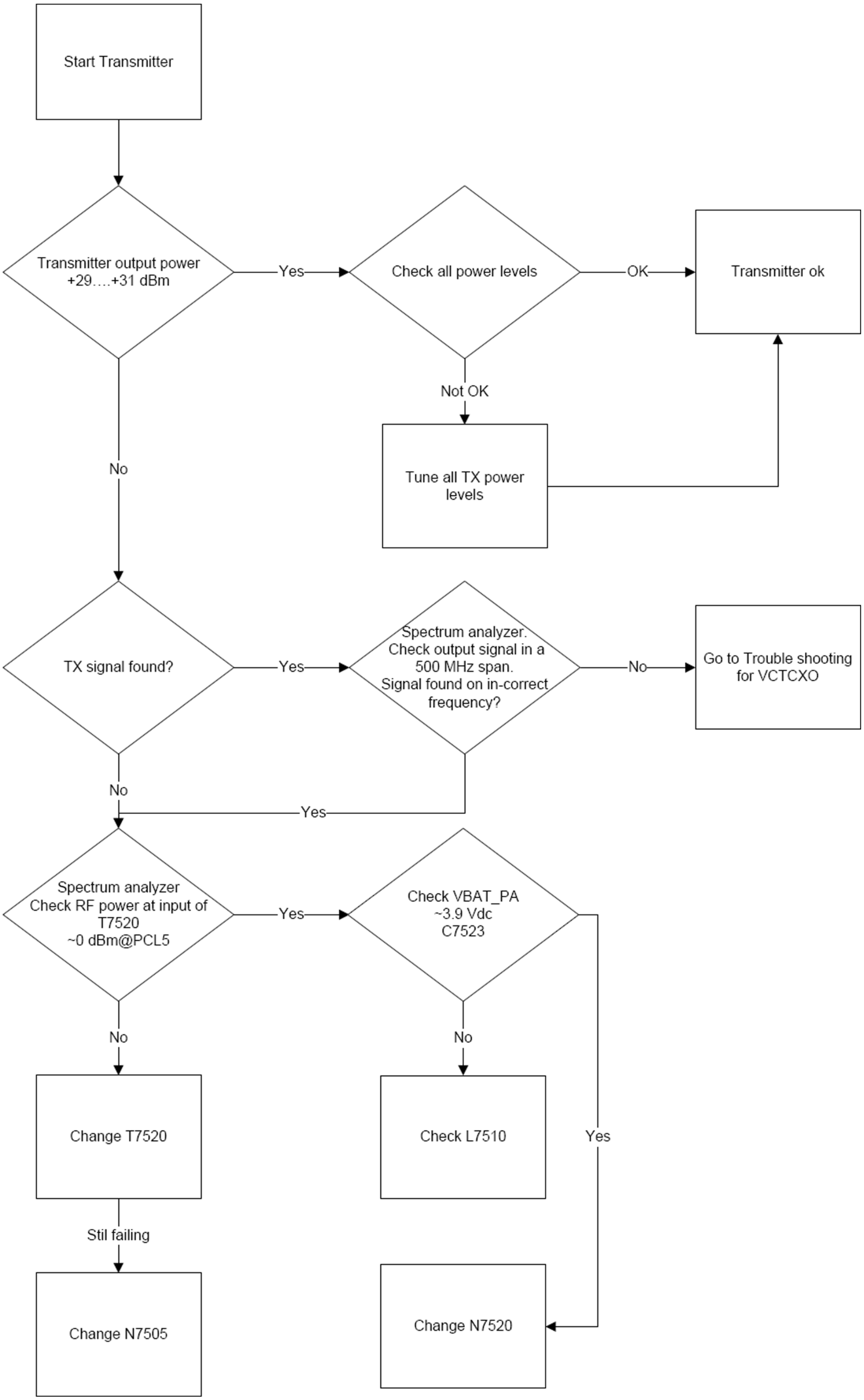
TX 850/900 troubleshooting

Troubleshooting flow


Start Transmitter
Transmitter output power +32….+34 dBm
Yes
Check all power levels
OK
Transmitter ok
Not OK
Tune all TX power levels
No
TX signal found?
Yes
Spectrum analyzer. Check output signal in a 500 MHz span. Signal found on in-correct frequency?
No
Go to VCTCXO troubleshooting
No
Yes
Spectrum analyzer Check RF power at R7521 ~0 dBm@PCL5
Yes
Check VBAT_PA ~3.9 Vdc C7523
Yes
Change N7520
No
No
Change Z7503
Check L7510
Stil failing
Change N7505

TX 1800/1900 troubleshooting

Troubleshooting flow


Start Transmitter
Transmitter output power +29….+31 dBm
Yes
Check all power levels
OK
Transmitter ok
Not OK
Tune all TX power levels
No
TX signal found?
Yes
Spectrum analyzer. Check output signal in a 500 MHz span. Signal found on in-correct frequency?
No
Go to Trouble shooting for VCTCXO
No
Yes
Spectrum analyzer Check RF power at input of T7520 ~0 dBm@PCL5
Yes
Check VBAT_PA ~3.9 Vdc C7523
No
No
Yes
Change T7520
Check L7510
Stil failing
Change N7505
Change N7520

Checking antenna functionality

Antenna overview

The device has a main GSM+WCDMA antenna and a BT antenna.

The main antenna has three pogopins (one feed and two GND contacts) and an antenna foil.

The BT antenna consists of two pogopins and a BT antenna foil.

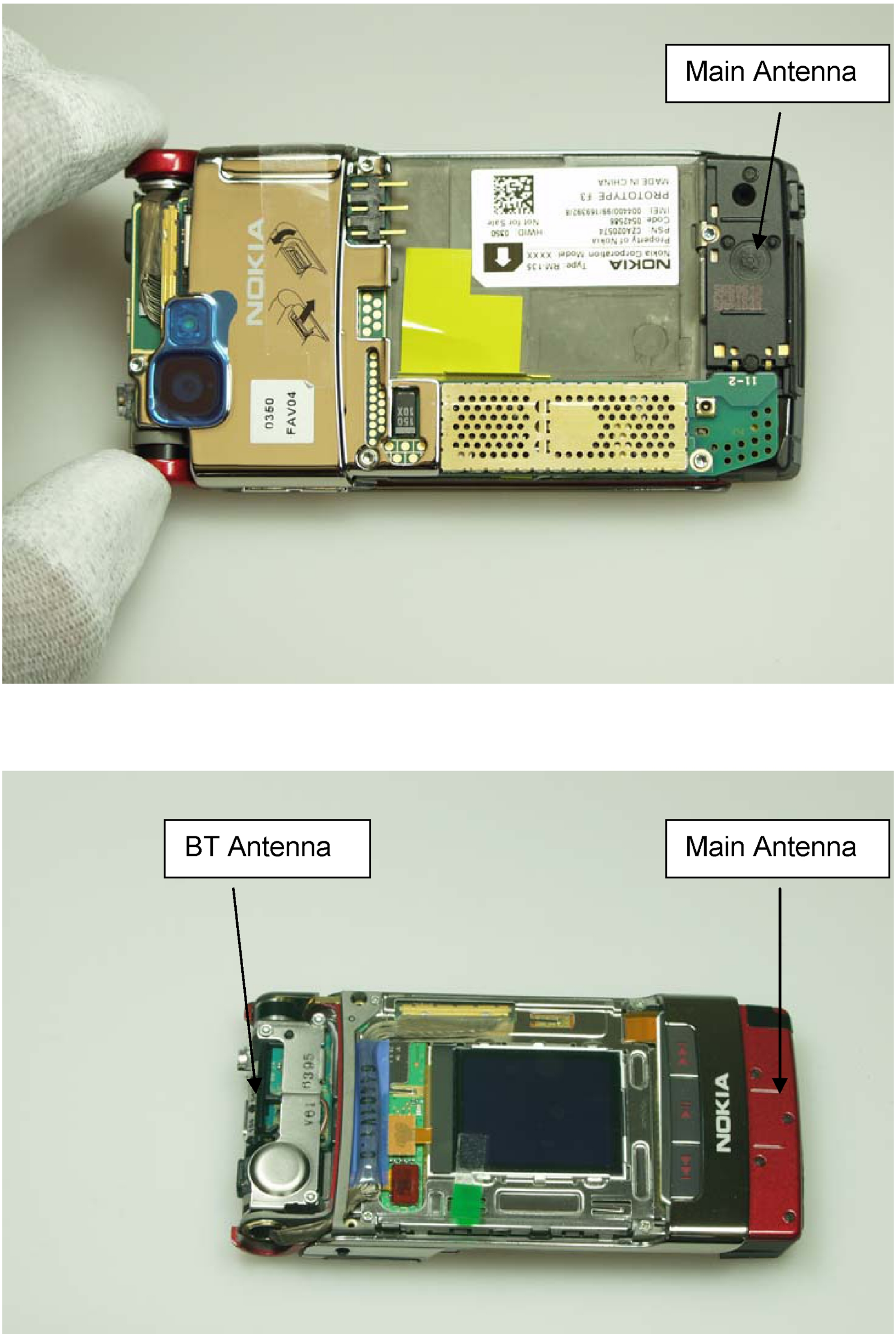

Main Antenna
BT Antenna
Main Antenna

Figure 56 Bluetooth and main antenna

Main antenna functionality

The main GSM+WCDMA antenna is functioning normally when the feed and GND pogopins take proper contact to the PWB, and the antenna foil is visually intact in the antenna frame.

The main antenna functionality must also be checked by measuring the transmitted power with RF coupler at GSM900 channel 124.

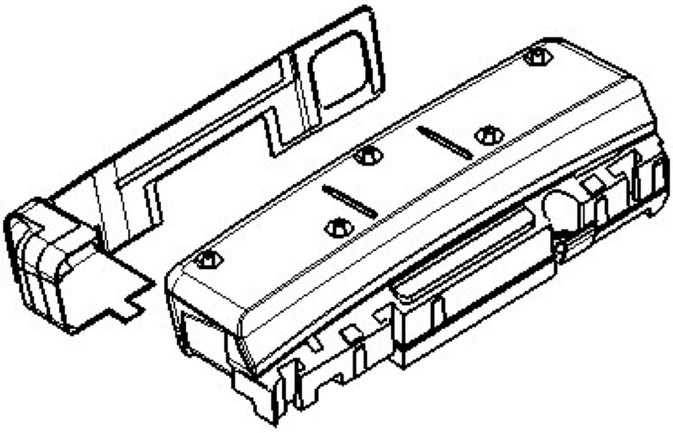


Figure 57 Main antenna components

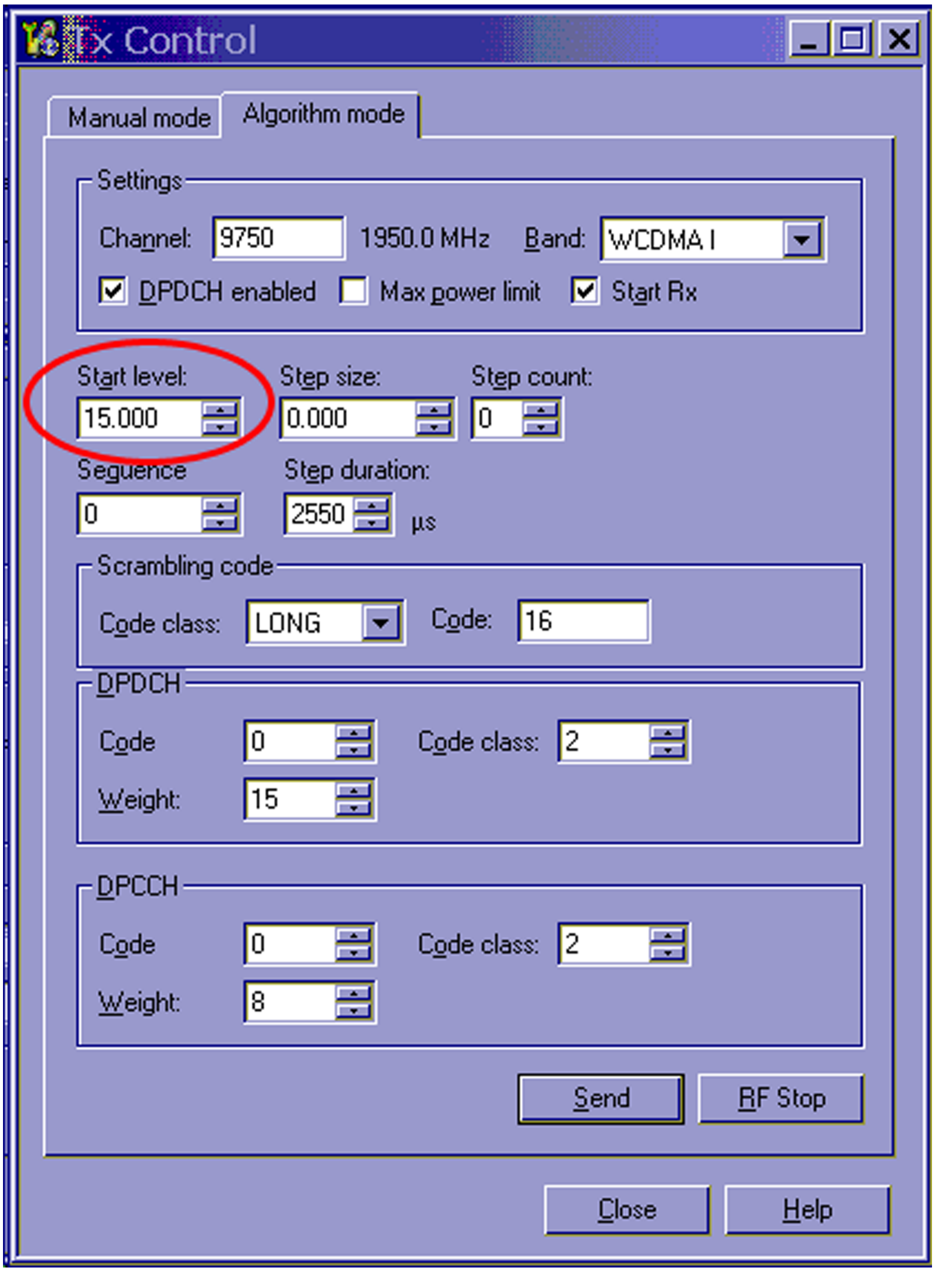
BT antenna functionality

The BT antenna is functioning normally when the BT pogopins take proper contact to the PWB, and the BT antenna foil is visually intact in the C-cover.

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing→WCDMA→TX control** .
3. Use the following settings in the TX control window:



Settings

Channel: 9750 1950.0 MHz Band: WCDMA I

☑ DPDCH enabled ☐ Max power limit ☑ Start Rx

Start level: 15.000

Step size: 0.000

Step count: 0

Sequence: 0

Step duration: 2550 µs

Scrambling code

Code class: LONG Code: 16

DPDCH

Code: 0 Code class: 2

Weight: 15

DPCCH

Code: 0 Code class: 2

Weight: 8

Figure 58 Phoenix WCDMA TX control window

Note: Use the **Start level** option to set the TX power level.

4. Click **Send** to enable the settings and activate TX.

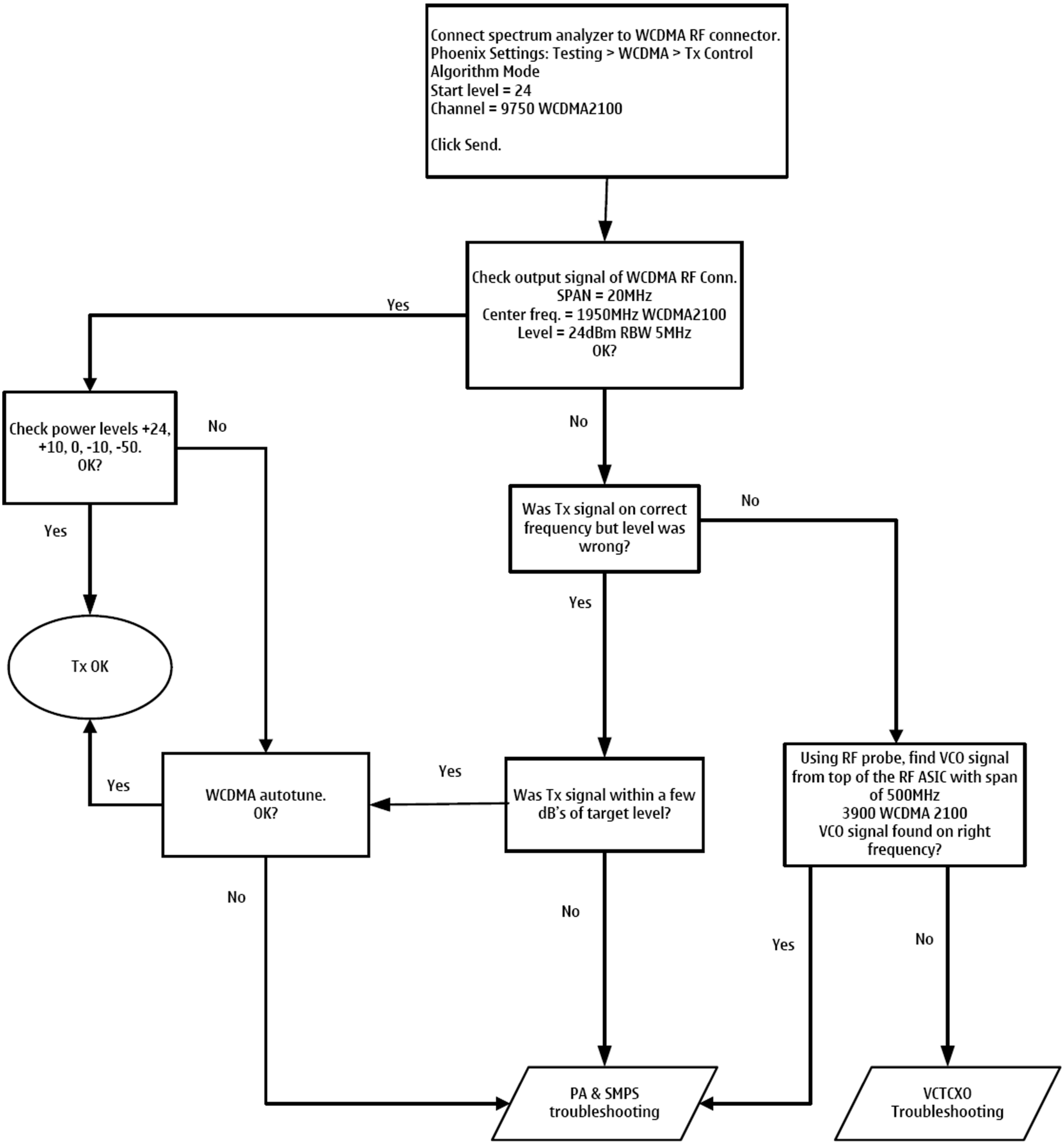
   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.

5. Use the CMU200 to check the WCDMA power.

Figure 59 WCDMA power window

WCDMA transmitter troubleshooting flowchart

Troubleshooting flow


Connect spectrum analyzer to WCDMA RF connector.
Phoenix Settings: Testing > WCDMA > Tx Control
Algorithm Mode
Start level = 24
Channel = 9750 WCDMA2100
Click Send.
Check output signal of WCDMA RF Conn.
SPAN = 20MHz
Center freq. = 1950MHz WCDMA2100
Level = 24dBm RBW 5MHz
OK?
Yes
No
Check power levels +24, +10, 0, -10, -50.
OK?
No
Yes
Was Tx signal on correct frequency but level was wrong?
No
Yes
Tx OK
Yes
WCDMA autotune.
OK?
Yes
Was Tx signal within a few dB's of target level?
Using RF probe, find VCO signal from top of the RF ASIC with span of 500MHz
3900 WCDMA 2100
VCO signal found on right frequency?
No
No
Yes
No
PA & SMPS troubleshooting
VCTCXO Troubleshooting

RF tunings

Introduction to RF tunings

Important: Only perform RF tunings if:

- one or more of the RF components have been replaced
- flash memory chip is replaced or corrupted.

RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF part.

Important: After RF component replacements, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup.

For RF attenuations of the module jig, please refer to the Service tools section.

Autotuning for BB5

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRF-1 (RF cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

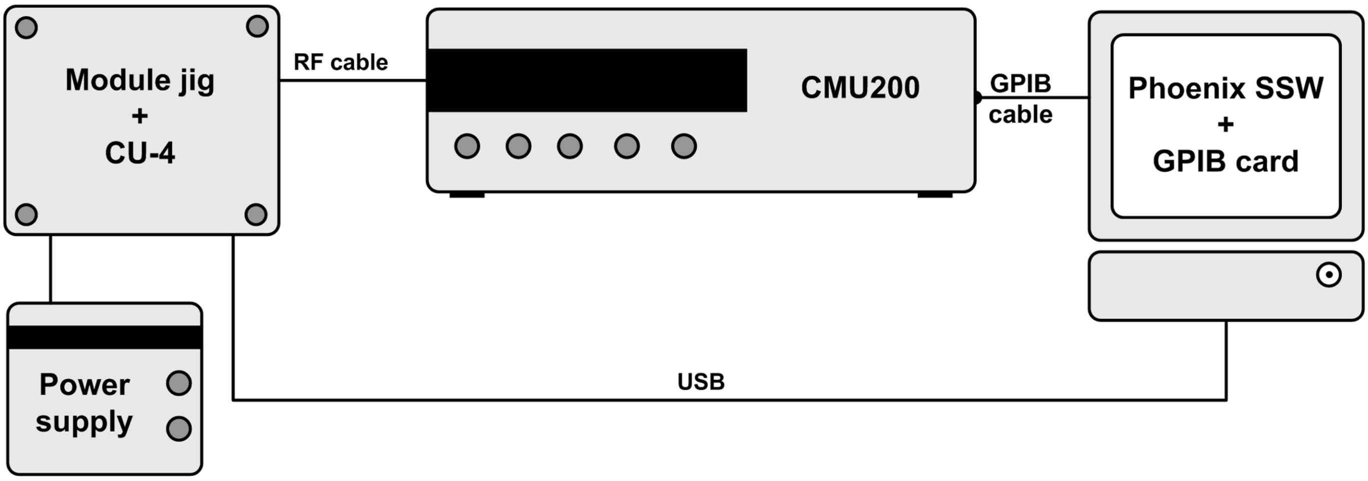


Figure 60 Auto tuning concept with CMU200

Phoenix preparations

Install the phone-specific data package. This defines the phone-specific settings.

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.

2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.

3 Remember to set the correct attenuation values before autotuning.

4 To start autotuning, click the *Tune* button.

System mode independent manual tunings

RF channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of the RF ASIC, that limit the bandwidth of BB IQ signals.

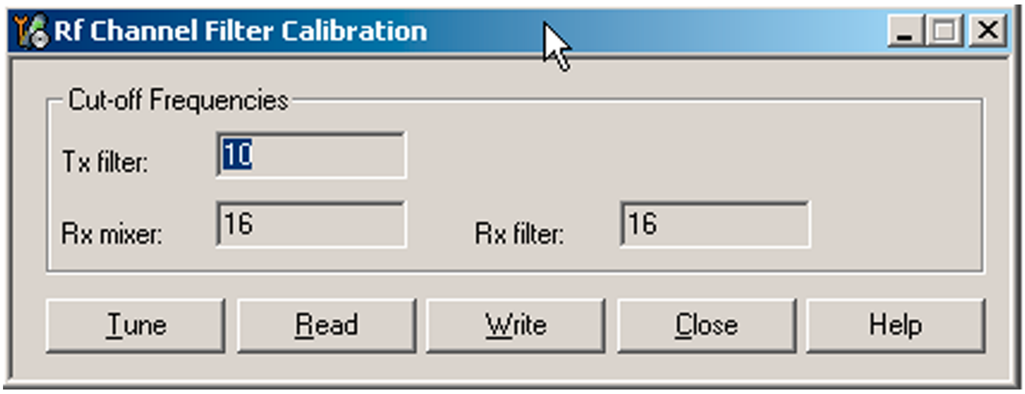
Table 6 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
RX mixer	0	13	31
Rx filter	0	16	31

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results


Rf Channel Filter Calibration

Cut-off Frequencies

Tx filter: 10

Rx mixer: 16

Rx filter: 16

Figure 61 Rf channel filter calibration typical values

PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

GSM receiver tunings

Rx calibration (GSM)

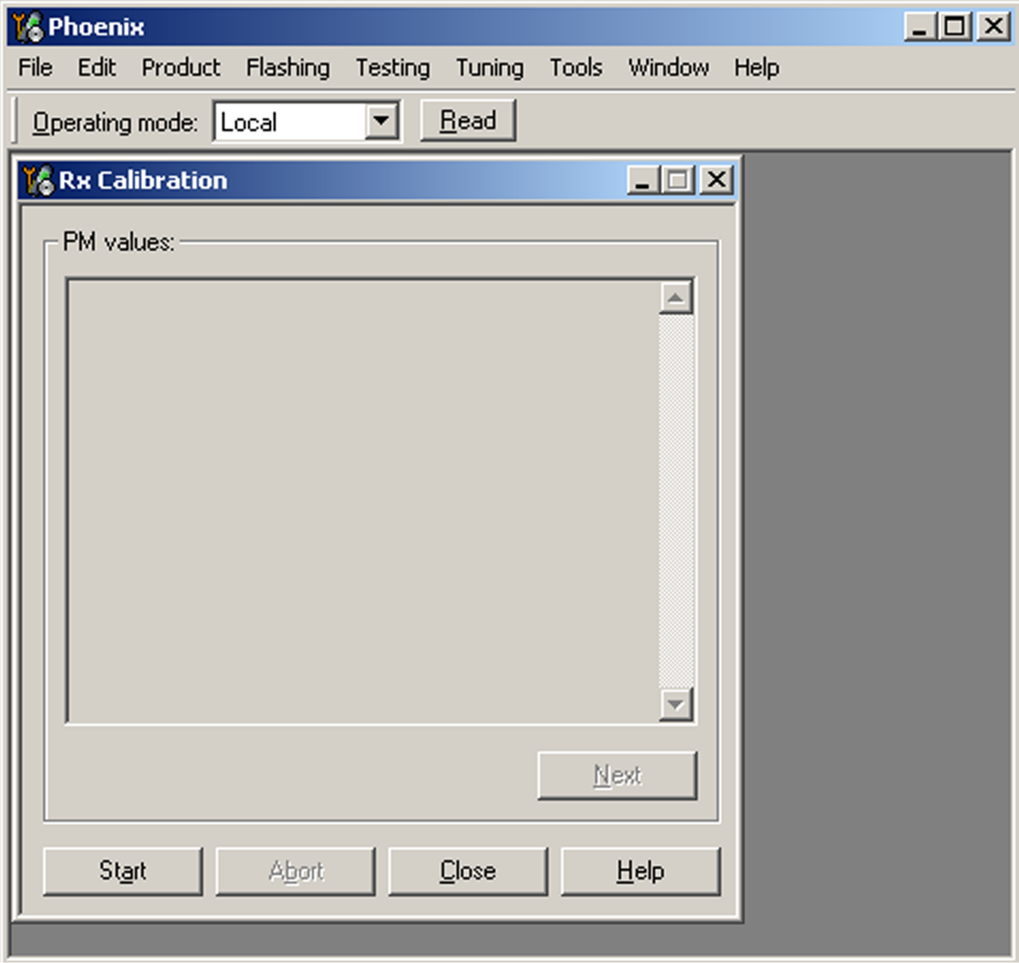
Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

Steps

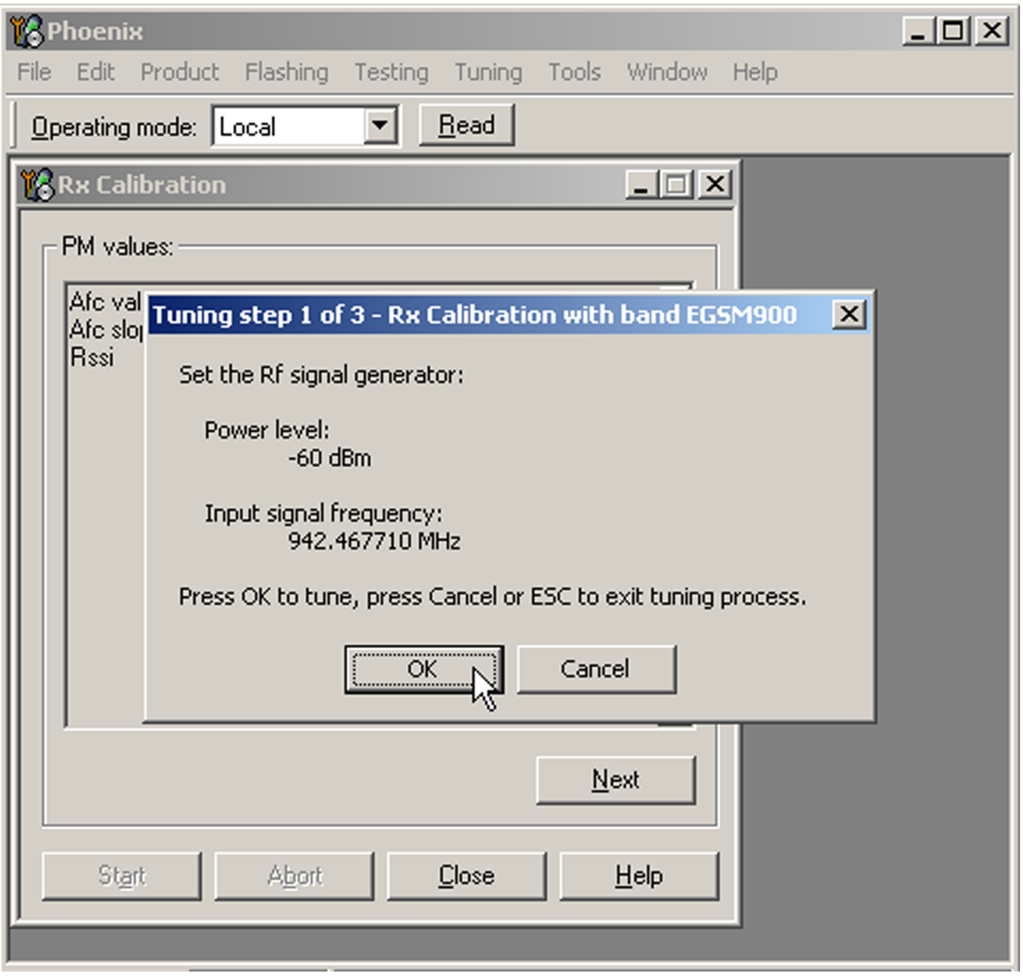
1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Rx Calibration** .

5. Click **Start**.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
Rx Calibration
PM values:
Next
Start
Abort
Close
Help

6. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** (step 1-3) pop-up window.

   Important: The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
Rx Calibration
PM values:
Afc val
Afc slo
Rssi
Tuning step 1 of 3 - Rx Calibration with band EGSM900
OK
Cancel
Next
Start
Abort
Close
Help

Set the Rf signal generator:

Power level:
-60 dBm

Input signal frequency:
942.467710 MHz

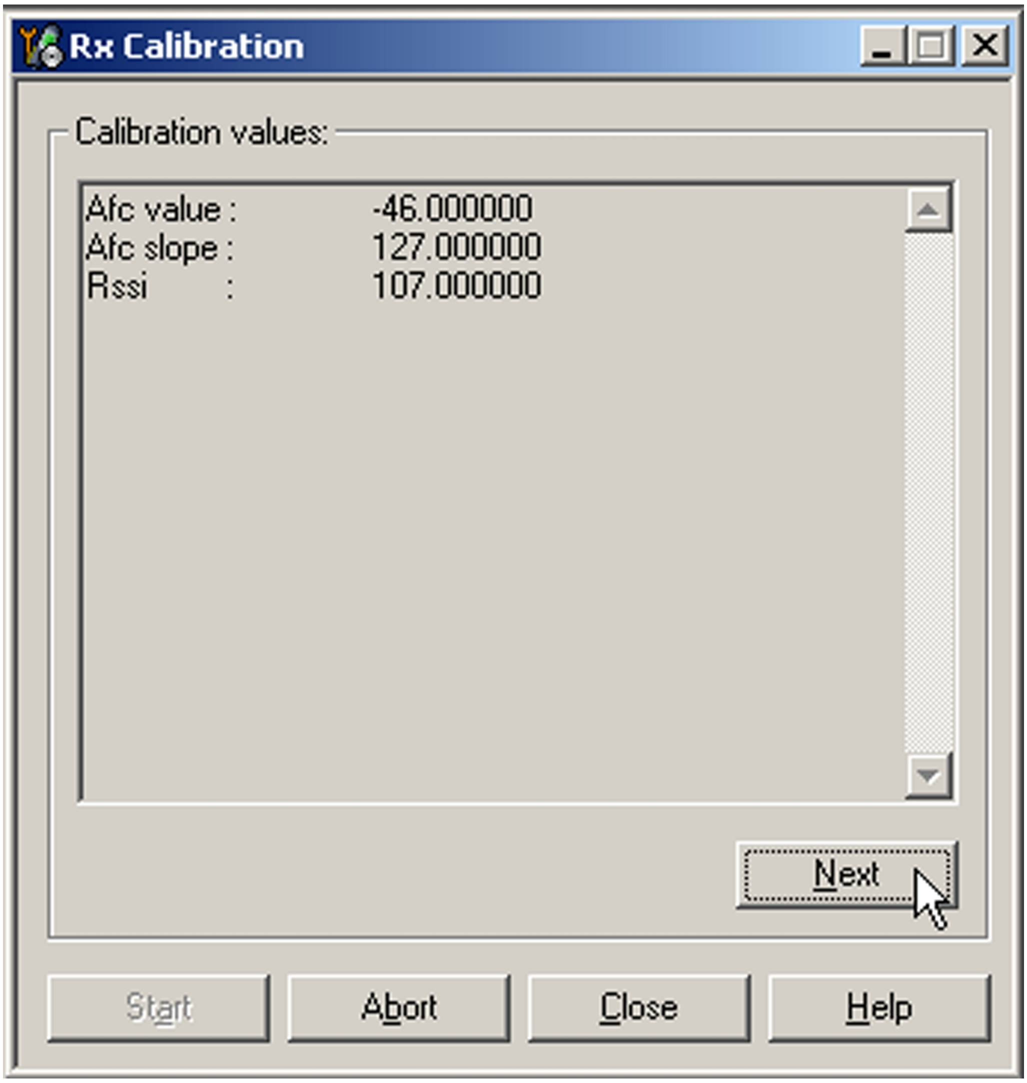
Press OK to tune, press Cancel or ESC to exit tuning process.

7. To perform the tuning, click **OK**.
8. Check that the tuning values are within the limits specified in the following table:

Table 7 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
AFC Value (init)	-200	-80..40	200	dB
AFC slope	0	108..121	200	dB
RSSI (AGC-0)	106	107..110	114	dB
GSM900				
AFC Value (init)	-200	-105..62	200	dB
AFC slope	0	122	200	dB
RSSI (AGC-0)	106	107...110	114	dB
GSM1800				
RSSI (AGC-0)	105	105...109	114	dB
GSM1900				
RSSI (AGC-0)	105	105...109	114	dB

9. Click **Next** to continue with GSM1800 Rx tuning.



```
Afc value :        -46.000000
Afc slope :        127.000000
Rssi      :        107.000000
```

Next actions

Repeat steps 6 to 9for GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Prerequisites

Rx calibration must be performed before the Rx band filter response compensation.

Context

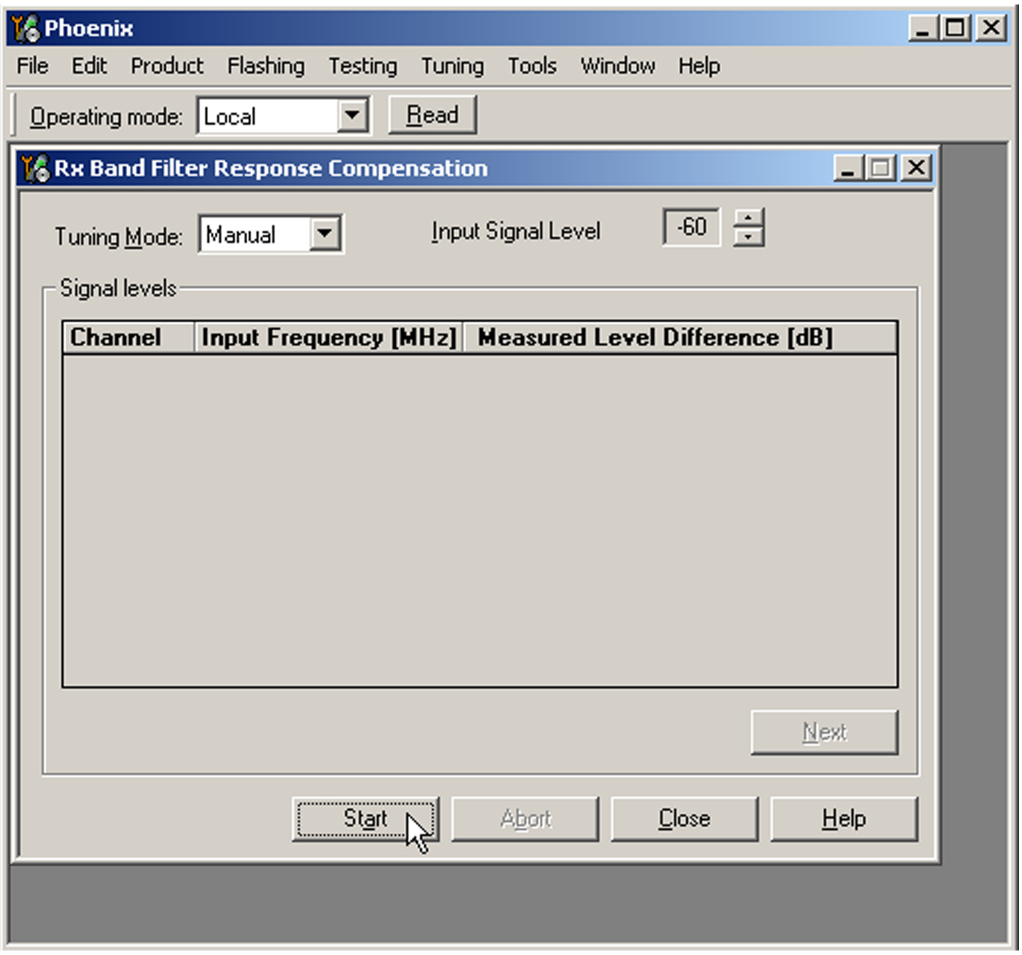
On each GSM Rx band, there is a band filter in front of the RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement, and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

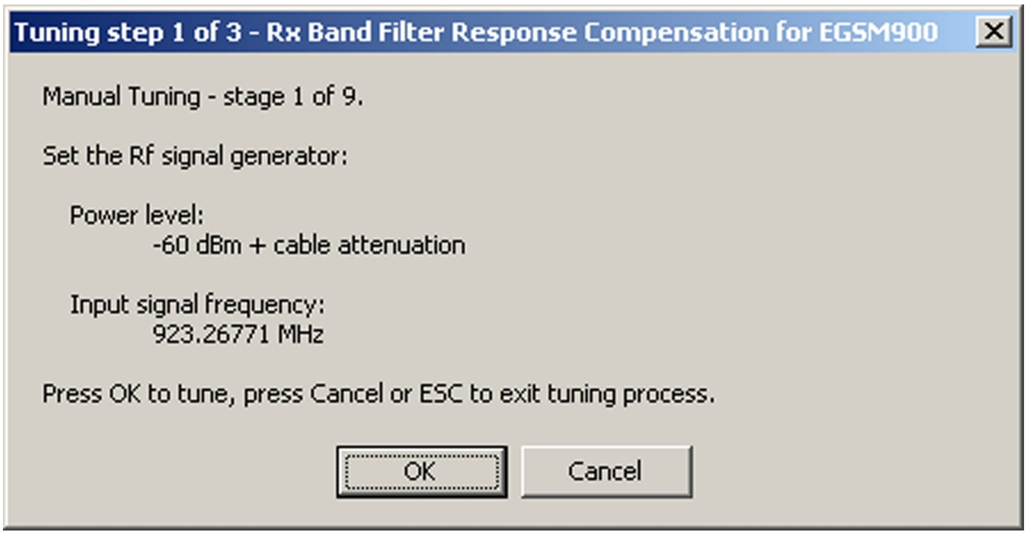
Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.

4. Select **GSM900** band.
5. Choose **Tuning→GSM→Rx Band Filter Response Compensation** .
6. Select **Tuning mode: manual**
7. Click **Start**.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
Rx Band Filter Response Compensation
Tuning Mode: Manual
Input Signal Level -60
Signal levels
Channel
Input Frequency [MHz]
Measured Level Difference [dB]
Next
Start
Abort
Close
Help

8. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the *Rx Band Filter Response Compensation for EGSM900* pop-up window, step 1-3.


Tuning step 1 of 3 - Rx Band Filter Response Compensation for EGSM900
OK
Cancel

Manual Tuning - stage 1 of 9.

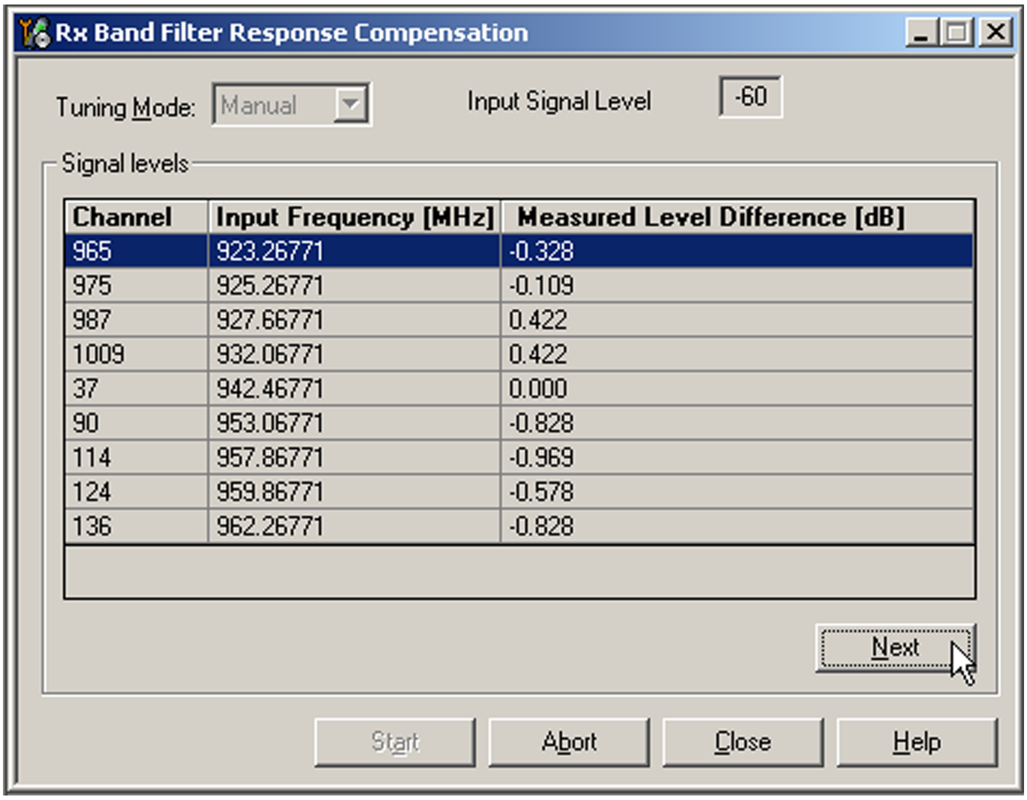
Set the Rf signal generator:

Power level:
-60 dBm + cable attenuation

Input signal frequency:
923.26771 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

9. To perform tuning, click **OK**.
10. Go through all 9 frequencies. The following table will be shown:



Tuning Mode: Manual

Input Signal Level -60

Signal levels

Channel	Input Frequency [MHz]	Measured Level Difference [dB]
965	923.26771	-0.328
975	925.26771	-0.109
987	927.66771	0.422
1009	932.06771	0.422
37	942.46771	0.000
90	953.06771	-0.828
114	957.86771	-0.969
124	959.86771	-0.578
136	962.26771	-0.828

11. Check that the tuning values are within the limits specified in the following table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118/867.26771 MHz	-6	-1	2	dB
Ch. 128/869.26771 MHz	-3	0	2	dB
Ch. 140/871.66771 MHz	-3	0	2	dB
Ch. 172/878.06771 MHz	-2	0	2	dB
Ch. 190/881.66771 MHz	-2	0	2	dB
Ch. 217 / 887.06771 MHz	-2	0	2	dB
Ch. 241/891.86771 MHz	-3	0	2	dB
Ch. 251/893.86771 MHz	-3	0	2	dB
Ch. 261/895.86771 MHz	-6	-1	-2	dB
GSM900				
Ch. 965 / 923.26771 MHz	-6	-1	2	dB
Ch. 975 / 925.26771 MHz	-3	0	2	dB
Ch. 987 / 927.66771 MHz	-3	0	2	dB
Ch. 1009 / 932.06771 MHz	-2	0	2	dB

	Min	Typ	Max	Unit
Ch. 37 / 942.46771 MHz	-2	0	2	dB
Ch. 90 / 953.06771 MHz	-2	0	2	dB
Ch. 114 / 957.86771 MHz	-3	0	2	dB
Ch. 124 / 959.86771 MHz	-3	0	2	dB
Ch. 136 / 962.26771 MHz	-6	-1	2	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-6	-1	3	dB
Ch. 512 / 1805.26771 MHz	-3	0	3	dB
Ch. 535 / 1809.86771 MHz	-3	0	3	dB
Ch. 606 / 1824.06771 MHz	-3	0	3	dB
Ch. 700 / 1842.86771 MHz	-3	0	3	dB
Ch. 791 / 1861.06771 MHz	-3	0	3	dB
Ch. 870 / 1876.86771 MHz	-3	0	3	dB
Ch. 885 / 1879.86771 MHz	-3	0	3	dB
Ch. 908 / 1884.46771 MHz	-6	-1	3	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-6	-1	2	dB
Ch. 512 / 1930.26771 MHz	-3	0	2	dB
Ch. 537 / 1935.26771 MHz	-3	0	2	dB
Ch. 586 / 1945.06771 MHz	-3	0	2	dB
Ch. 661 / 1960.06771 MHz	-3	0	2	dB
Ch. 736 / 1975.06771 MHz	-3	0	2	dB
Ch. 794 / 1986.66771 MHz	-3	0	2	dB
Ch. 810 / 1989.86771 MHz	-3	0	2	dB
Ch. 835 / 1994.86771 MHz	-6	-1	2	dB

12. If the values are within the limits, click **Next** to continue to the next band.

Next actions

Repeat the steps 8 to 12 for GSM1800 and GSM1900.

GSM transmitter tunings

Tx IQ tuning (GSM)

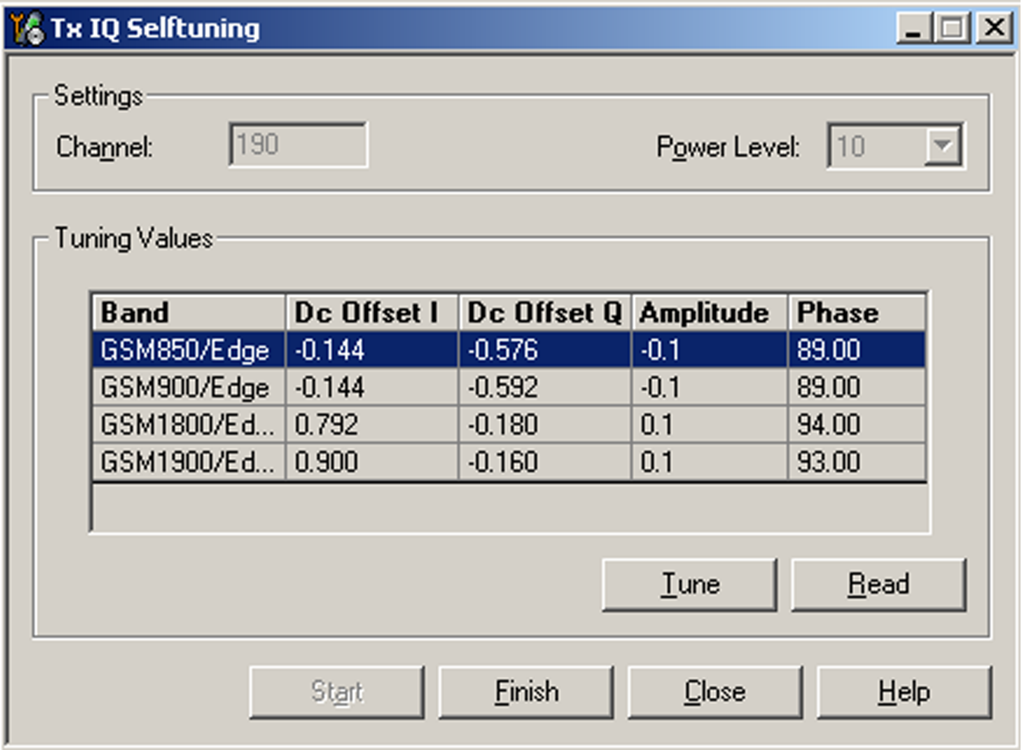
Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.

Tx IQ tuning must be performed for all GSM bands.

Steps

1. Start *Phoenix* service software.
2. From the **Operating mode** drop-down menu, set mode to **Local**.
3. Choose **Tuning→GSM→Tx IQ Tuning** .
4. Select **Mode: Automatic**.



Channel: 190

Power Level: 10

Band	Dc Offset I	Dc Offset Q	Amplitude	Phase
GSM850/Edge	-0.144	-0.576	-0.1	89.00
GSM900/Edge	-0.144	-0.592	-0.1	89.00
GSM1800/Ed...	0.792	-0.180	0.1	94.00
GSM1900/Ed...	0.900	-0.160	0.1	93.00

5. Select **Band: GSM900** and click **Start**.
6. Click **Next** to start GSM1800 band TX IQ tuning.
7. Click **Next** to start GSM1900 band TX IQ tuning.
8. Click**Finish** and then **Close**.

Next actions

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the following table. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM900				

	Min	Typ	Max	Unit
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	°

Tx power level tuning (GSM)

Context

Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

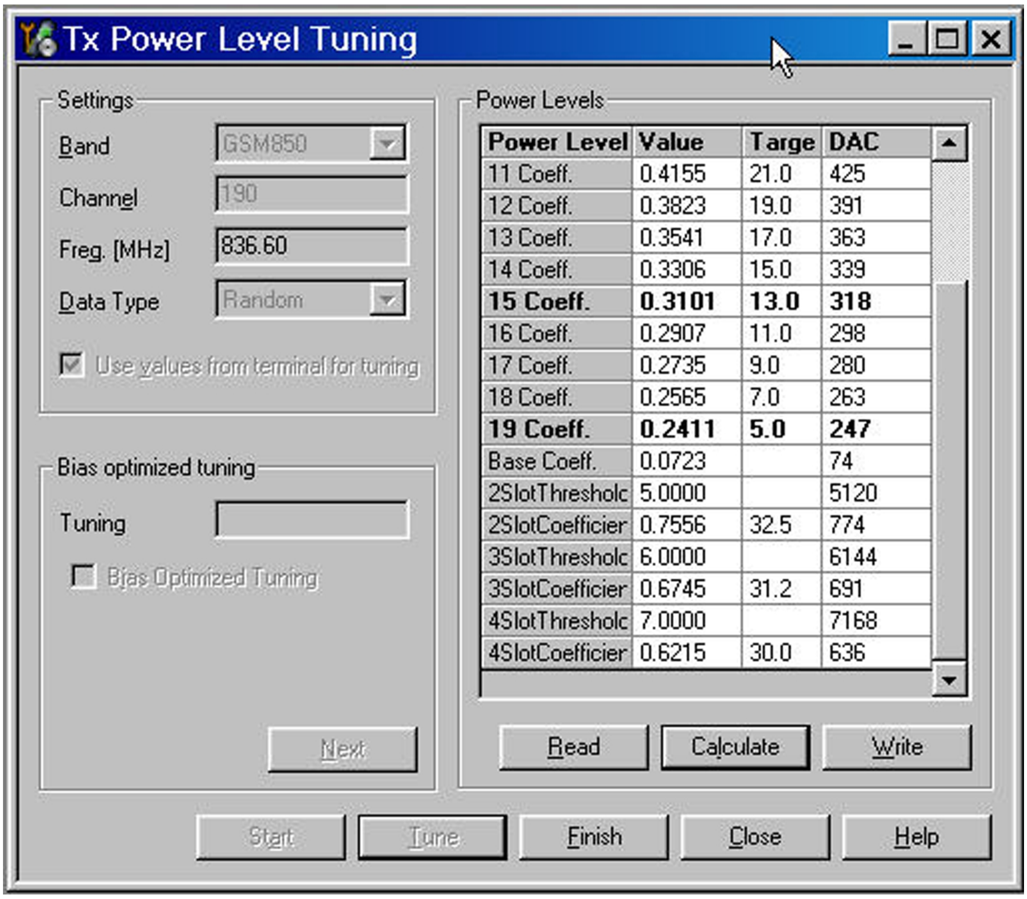
For EDGE transmission, the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a spectrum analyzer.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Tx Power Level Tuning** .

5. Click **Start**.l



Tx Power Level Tuning
Settings
Bias optimized tuning
Power Levels
Next
Read
Calculate
Write
Start
Tune
Finish
Close
Help

Band: GSM850
Channel: 190
Freq. [MHz]: 836.60
Data Type: Random
☑ Use values from terminal for tuning

Tuning:
☐ Bias Optimized Tuning

Power Level	Value	Targe	DAC
11 Coeff.	0.4155	21.0	425
12 Coeff.	0.3823	19.0	391
13 Coeff.	0.3541	17.0	363
14 Coeff.	0.3306	15.0	339
15 Coeff.	**0.3101**	**13.0**	**318**
16 Coeff.	0.2907	11.0	298
17 Coeff.	0.2735	9.0	280
18 Coeff.	0.2565	7.0	263
19 Coeff.	**0.2411**	**5.0**	**247**
Base Coeff.	0.0723		74
2SlotThresholc	5.0000		5120
2SlotCoefficier	0.7556	32.5	774
3SlotThresholc	6.0000		6144
3SlotCoefficier	0.6745	31.2	691
4SlotThresholc	7.0000		7168
4SlotCoefficier	0.6215	30.0	636

6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: • **836.6 MHz GSM850** • **897.4MHz GSM900** • **1747.8MHz GSM1800** • **1880MHz GSM1900**
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)
Resolution BW	3MHz
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations into account.

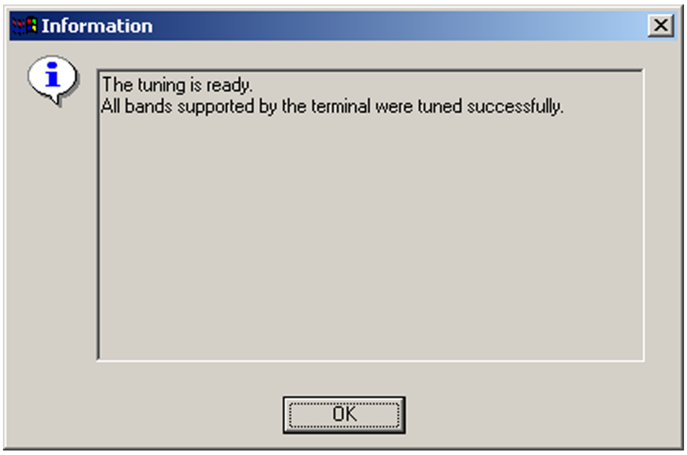
7. Set the tuning targets according to the values in the table below

GMSK	**1 slot**	**2 slot**	**3 slot**
850	32.5 dBm	32.0 dBm	30.5 dBm
900	32.5 dBm	32.0 dBm	30.5 dBm
1800	29.5 dBm	29.5 dBm	29.5 dBm
1900	29.5 dBm	29.5 dBm	29.5 dBm
EDGE	**1 slot**	**2 slot**	**3 slot**
850	26,5dBm	26,5dBm	26,5dBm
900	26,5dBm	26,5dBm	26,5dBm
1800	25dBm	25dBm	25dBm
1900	25dBm	25dBm	25dBm
WCDMA Band I	23.5 dBm		

8. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.
9. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.
10. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:



The tuning is ready.
All bands supported by the terminal were tuned successfully.

WCDMA receiver tunings

RX calibration (WCDMA)

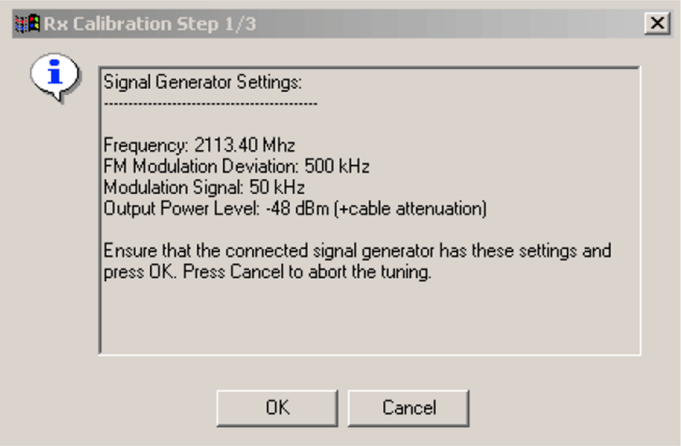
Context

Rx calibration tuning routine calculates the real gain values of the WCDMA Rx AGC system. There is also a SAW filter between front end LNA and mixer in the receive chain, which causes ripple in the RSSI measurement, this is calibrated out. The SAW filter is intergated into RF ASIC N7500.

Rx calibration can be done in two different ways, manual tune and sweep mode tune. If the signal generator in use supports frequency sweep table, the calibration is done in one step.

Steps

1. For manual tuning, set mode to **Local** in the **Operating Mode** dropdown menu.
2. In the **Tuning** menu, choose **WCDMA→Rx Calibration** .
3. Click **Start**.
4. Select Band "WCDMA 2100".
5. Click **Tune**.
6. Setup the signal generator to correspond with the values on the, *Rx Calibration* pop-up window and click **OK**.



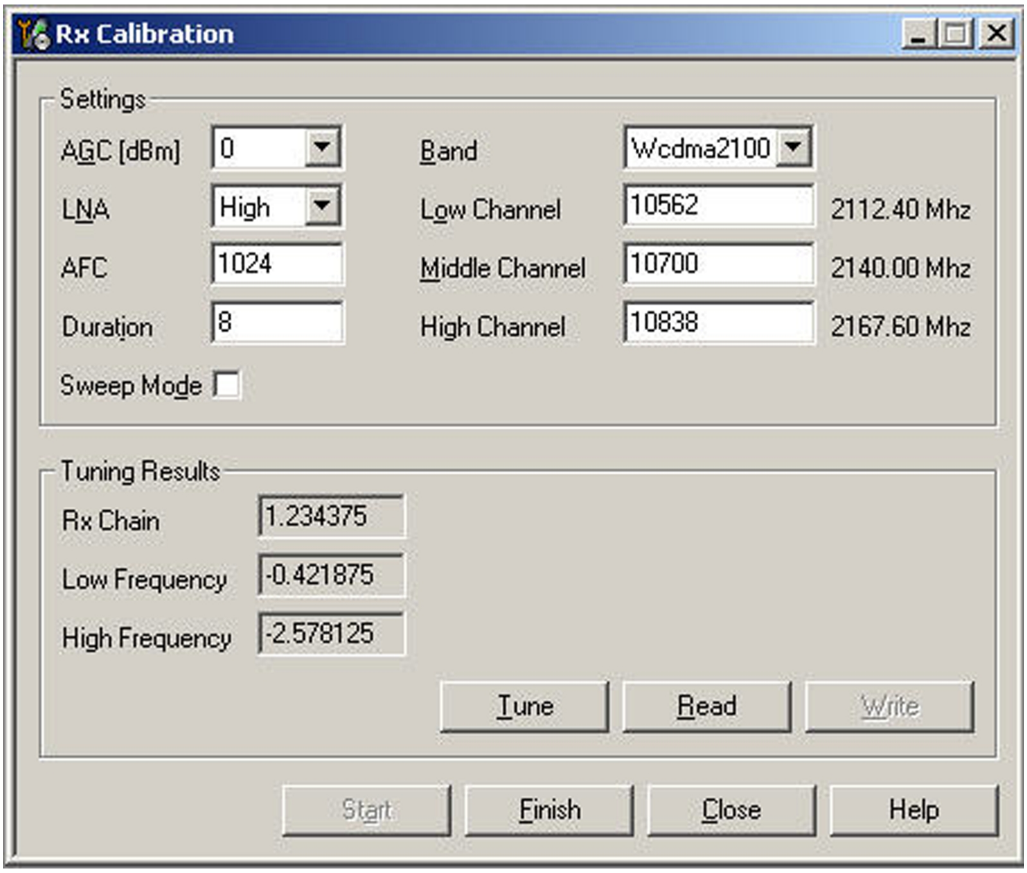
Signal Generator Settings:

Frequency: 2113.40 Mhz
FM Modulation Deviation: 500 kHz
Modulation Signal: 50 kHz
Output Power Level: -48 dBm (+cable attenuation)

Ensure that the connected signal generator has these settings and press OK. Press Cancel to abort the tuning.

Figure 62 Pop-up window for WCDMA2100

7. Repeat step 6. for Middle and High channels.



AGC [dBm]: 0
LNA: High
AFC: 1024
Duration: 8
Sweep Mode ☐
Band: Wcdma2100
Low Channel: 10562 2112.40 Mhz
Middle Channel: 10700 2140.00 Mhz
High Channel: 10838 2167.60 Mhz
Rx Chain: 1.234375
Low Frequency: -0.421875
High Frequency: -2.578125

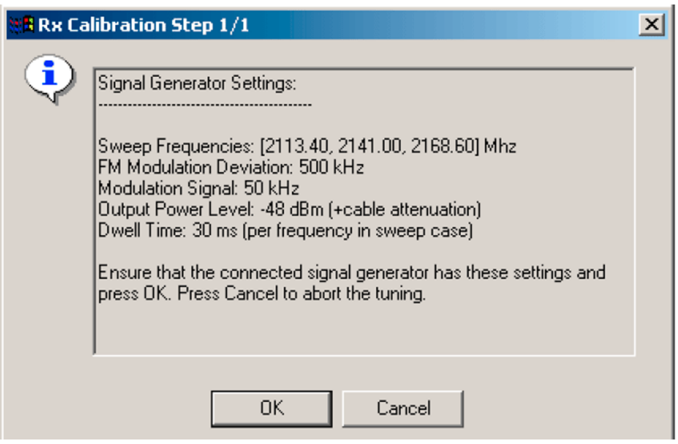
8. Ensure Tuning Results are within limits specified in the table below:
   If values are OK, click **Write** to save the values.

	Band	Min	Typ	Max	Unit
Rx chain	2100	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	

Alternative steps

- For sweep mode tuning, set **Mode** to **Local** in the **Operating Mode** dropdown menu.
- In the **Tuning** menu, choose **WCDMA→ Rx Calibration** .
- Click **Start**.
- Select **Band**, "WCDAM2100".
- Check the **Sweep Mode** box.
- Click **Tune**.

- Setup the signal generator to correspond with the values on the *Rx Calibration* pop-up window and click **OK**.



Signal Generator Settings:

Sweep Frequencies: [2113.40, 2141.00, 2168.60] Mhz
FM Modulation Deviation: 500 kHz
Modulation Signal: 50 kHz
Output Power Level: -48 dBm (+cable attenuation)
Dwell Time: 30 ms (per frequency in sweep case)

Ensure that the connected signal generator has these settings and press OK. Press Cancel to abort the tuning.

Figure 63 Pop-up window for WCDMA2100

- Ensure Tuning Results are within limits specified in the table above: If values are OK, click **Write** to save the values to the phone.
- Close the tuning window.

WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

Tx AGC & power detector tuning has two purposes:

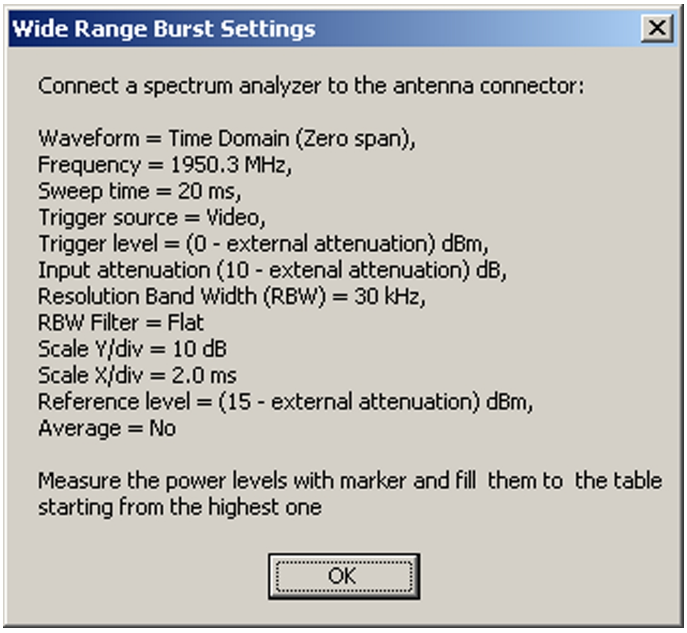
- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

There are two ways to perform the tuning. For an alternative method, see Alternative steps (page 5–50).

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→WCDMA→Tx AGC & Power Detector.**
3. Click **Start**.
4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).

5. Set up the spectrum analyzer in the following way:



Connect a spectrum analyzer to the antenna connector:

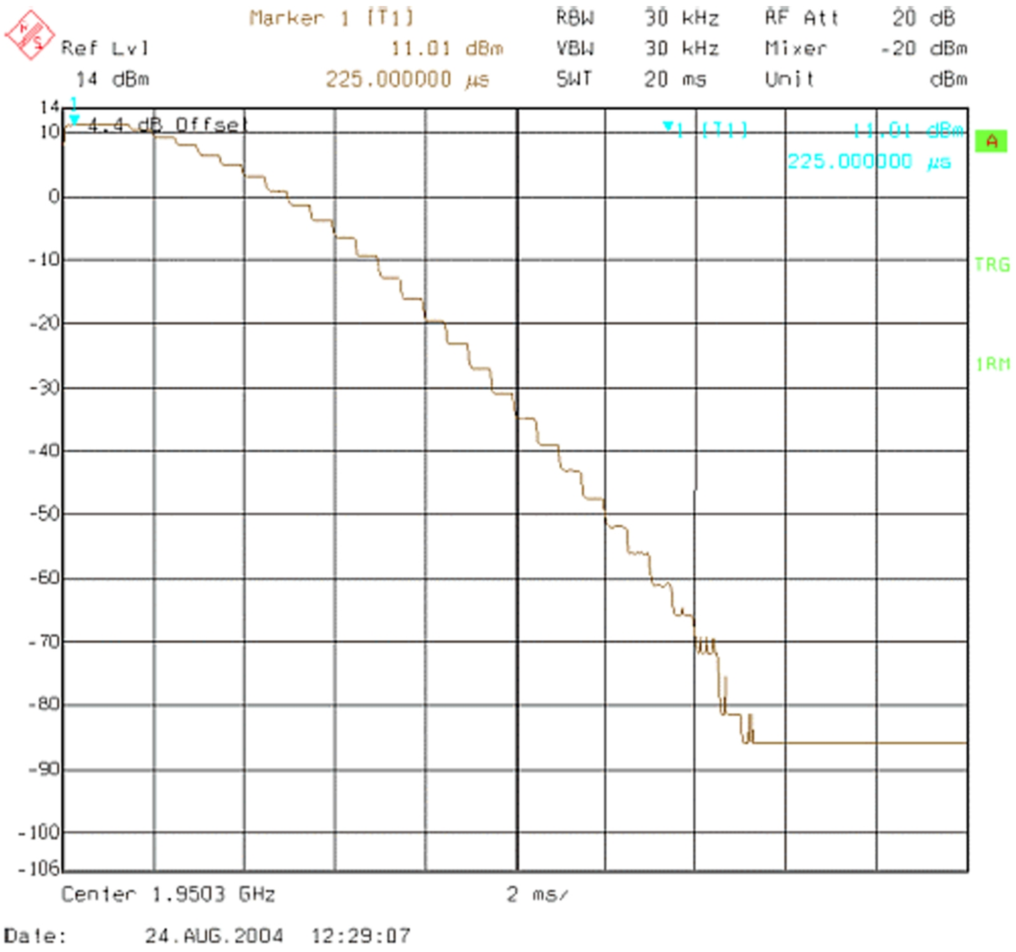
Waveform = Time Domain (Zero span),
Frequency = 1950.3 MHz,
Sweep time = 20 ms,
Trigger source = Video,
Trigger level = (0 - external attenuation) dBm,
Input attenuation (10 - extenal attenuation) dB,
Resolution Band Width (RBW) = 30 kHz,
RBW Filter = Flat
Scale Y/div = 10 dB
Scale X/div = 2.0 ms
Reference level = (15 - external attenuation) dBm,
Average = No

Measure the power levels with marker and fill them to the table starting from the highest one

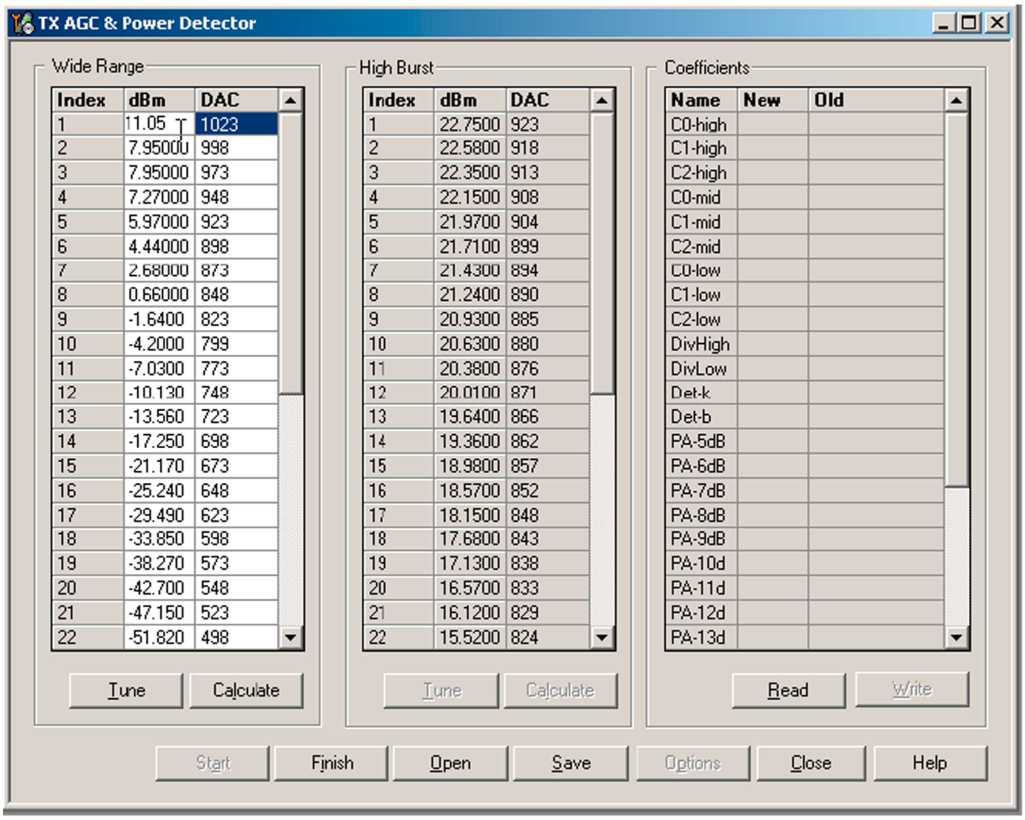
6. After setting the spectrum analyzer, click **OK**.
7. Measure the power levels with a marker.

   Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.

   > **Note:** It must be possible to measure power levels down to –68 dBm. The measured power levels must be monotonously decreasing.
   >
   > Make sure that the marker is not measuring the level of noise spikes on lower levels.


Marker 1 [T1]
11.01 dBm
225.000000 µs
Ref Lvl
14 dBm
RBW 30 kHz
VBW 30 kHz
SWT 20 ms
RF Att 20 dB
Mixer -20 dBm
Unit dBm
4.4 dB Offset
1 [T1] 11.01 dBm
225.000000 µs
A
TRG
1RM
14
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-106
Center 1.9503 GHz
2 ms/
Date: 24.AUG.2004 12:29:07

8. Fill in the power level values (in dBm) to the *Wide Range* table.



Wide Range

Index	dBm	DAC
1	11.05	1023
2	7.95000	998
3	7.95000	973
4	7.27000	948
5	5.97000	923
6	4.44000	898
7	2.68000	873
8	0.66000	848
9	-1.6400	823
10	-4.2000	799
11	-7.0300	773
12	-10.130	748
13	-13.560	723
14	-17.250	698
15	-21.170	673
16	-25.240	648
17	-29.490	623
18	-33.850	598
19	-38.270	573
20	-42.700	548
21	-47.150	523
22	-51.820	498

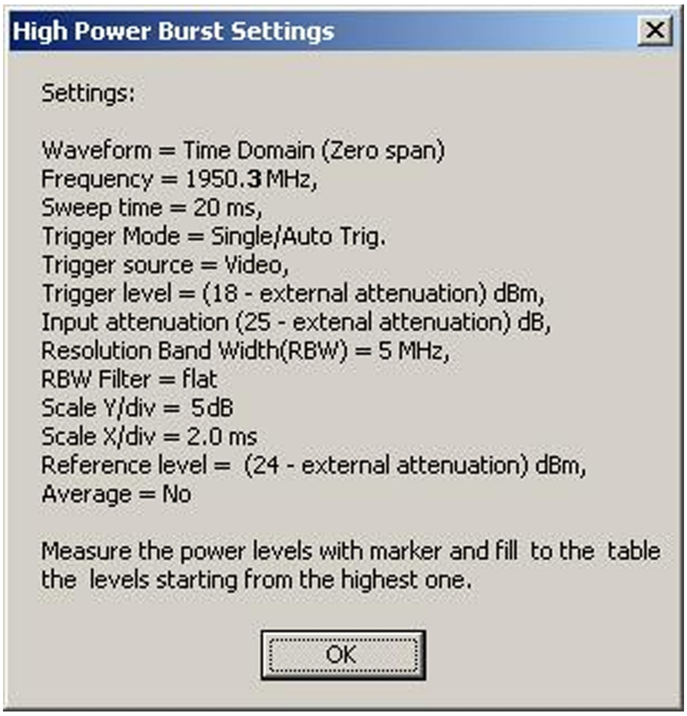
High Burst

Index	dBm	DAC
1	22.7500	923
2	22.5800	918
3	22.3500	913
4	22.1500	908
5	21.9700	904
6	21.7100	899
7	21.4300	894
8	21.2400	890
9	20.9300	885
10	20.6300	880
11	20.3800	876
12	20.0100	871
13	19.6400	866
14	19.3600	862
15	18.9800	857
16	18.5700	852
17	18.1500	848
18	17.6800	843
19	17.1300	838
20	16.5700	833
21	16.1200	829
22	15.5200	824

Coefficients

Name	New	Old
C0-high		
C1-high		
C2-high		
C0-mid		
C1-mid		
C2-mid		
C0-low		
C1-low		
C2-low		
DivHigh		
DivLow		
Det-k		
Det-b		
PA-5dB		
PA-6dB		
PA-7dB		
PA-8dB		
PA-9dB		
PA-10d		
PA-11d		
PA-12d		
PA-13d		

9. In the *Wide Range* pane, click **Calculate**.
10. In the *High Burst* pane, click **Tune**.
11. Adjust the spectrum analyzer according to the following settings:



Settings:

Waveform = Time Domain (Zero span)
Frequency = 1950.3 MHz,
Sweep time = 20 ms,
Trigger Mode = Single/Auto Trig.
Trigger source = Video,
Trigger level = (18 - external attenuation) dBm,
Input attenuation (25 - extenal attenuation) dB,
Resolution Band Width(RBW) = 5 MHz,
RBW Filter = flat
Scale Y/div = 5dB
Scale X/div = 2.0 ms
Reference level = (24 - external attenuation) dBm,
Average = No

Measure the power levels with marker and fill to the table the levels starting from the highest one.

12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.

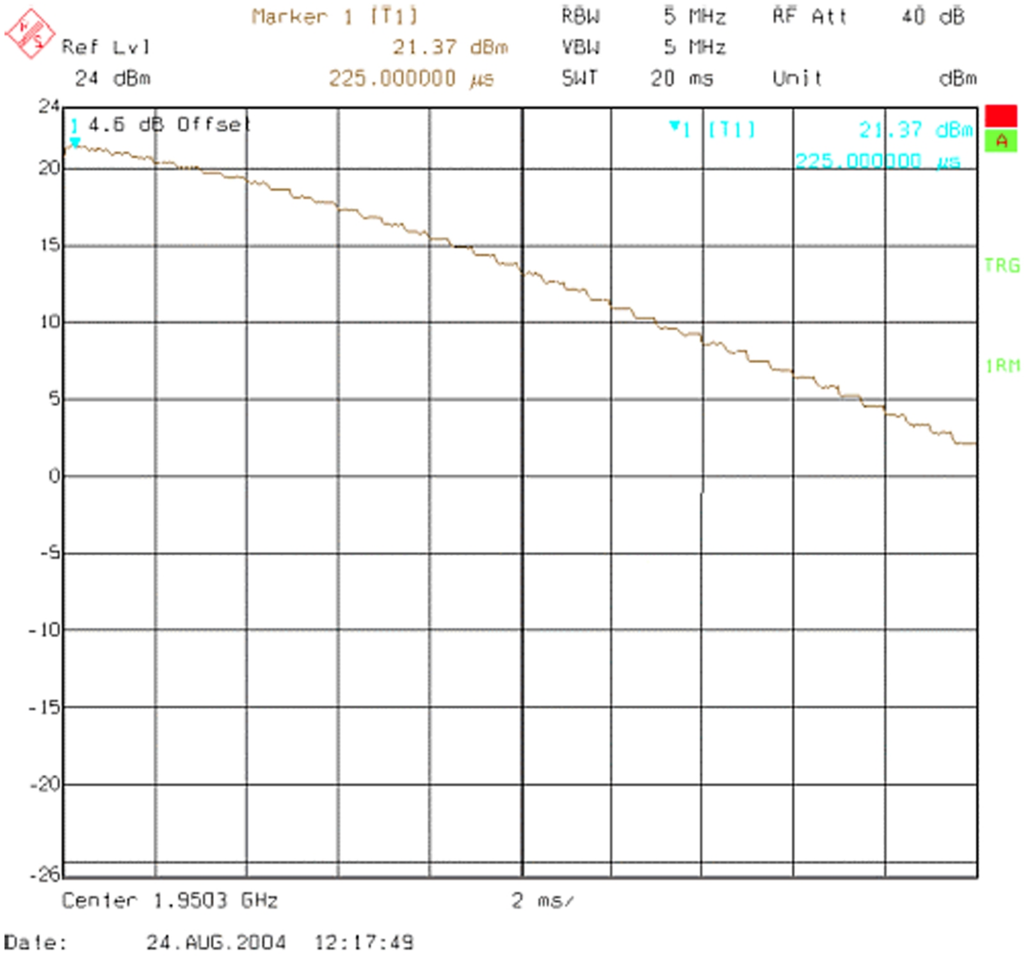

Marker 1 [T1]
21.37 dBm
225.000000 µs
Ref Lvl
24 dBm
RBW 5 MHz
VBW 5 MHz
SWT 20 ms
RF Att 40 dB
Unit dBm
1 4.6 dB Offset
▼1 [T1]
21.37 dBm
225.000000 µs
A
TRG
1RM
24
20
15
10
5
0
-5
-10
-15
-20
-26
Center 1.9503 GHz
2 ms/
Date: 24.AUG.2004 12:17:49

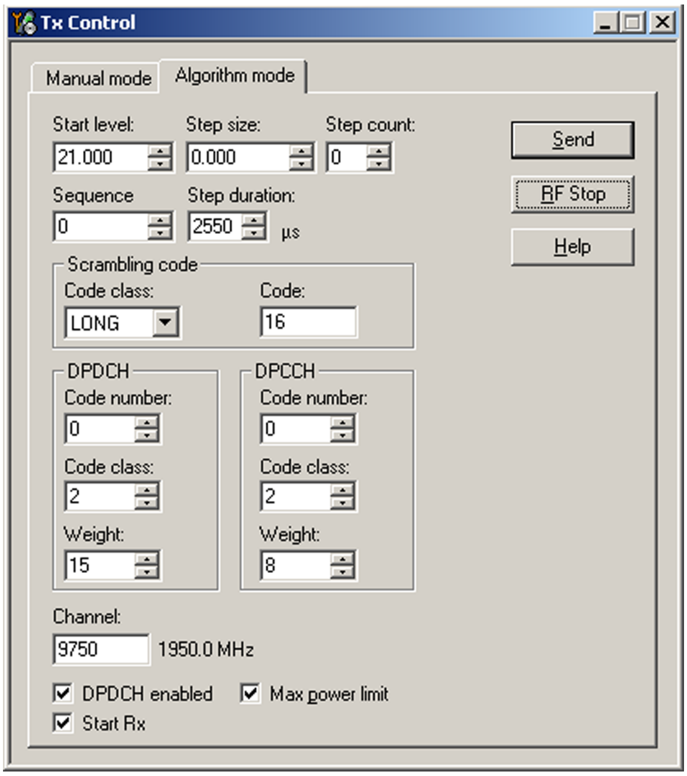
Figure 64 High burst measurement

13. In the *High Burst* pane, click **Calculate**.
14. Check that the calculated values are within the limits specified in the following table:

	Min	Max
C0-high	-0.5	5
C1-high	-50	50
C2-high	400	900
C0-mid	-0.7	0.7
C1-mid	0	50
C2-mid	400	900
C0-low	-4	4
C1-low	-400	440
C2-low	-10000	15000

	Min	Max
Det-k	100	220
Det-b	0	150

15. To save the coefficients to the phone, click **Write**.
16. To close the *Tx AGC & Power Detector* window, click **Close**.
17. Choose **Testing→WCDMA→ Tx Control.**
18. Select the *Algorithm* mode tab.



Start level: 21.000
Step size: 0.000
Step count: 0
Sequence: 0
Step duration: 2550 µs

Scrambling code
Code class: LONG
Code: 16

DPDCH
Code number: 0
Code class: 2
Weight: 15

DPCCH
Code number: 0
Code class: 2
Weight: 8

Channel: 9750 1950.0 MHz

☑ DPDCH enabled ☑ Max power limit
☑ Start Rx

19. Write the target power level 25 dBm to the *Start level* line and check the **Max power limit** check box (detector calibration check).
20. Setup the spectrum analyzer with the following settings:

Center frequency:	**1950.3 MHz**
Span:	0 Hz
Reference level offset:	Cable attenuations + adapter attenuation
Reference level:	**24 dBm or -20 dBm depending on the level measured**
Input attenuation:	Automatic
Resolution bandwidth:	5 MHz
Video bandwidth:	5 MHz
Sweep time:	20 ms
Detector:	**RMS detector**

Average:	No
Trigger:	Free run

21. Click **Send**.
22. Measure the WCDMA output power.

    It should be around 21 dBm.
23. Click **RF Stop** and uncheck the **Max power limit** check box.
24. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

    The measured output power may not differ more than +-2 dB from the requested value at level +19 dBm and no more than +-4 dB on lower levels.

    Remember to stop the RF before sending new data.

Alternative steps

- Measure the wide range levels normally and write down the levels that are possible to measure.
- Click **Finish**.
- Click **Options**.
- Change the first wide range DAC value to *573* and change the number of tuning steps to *21*.
- Change the spectrum analyzer reference level to *–20* dBm and adjust the input attenuator to the lowest value possible.
- In the *Wide Range* pane, click **Tune** and fill in the rest of values starting from the 19th level.

Tx band response calibration (WCDMA)

Context

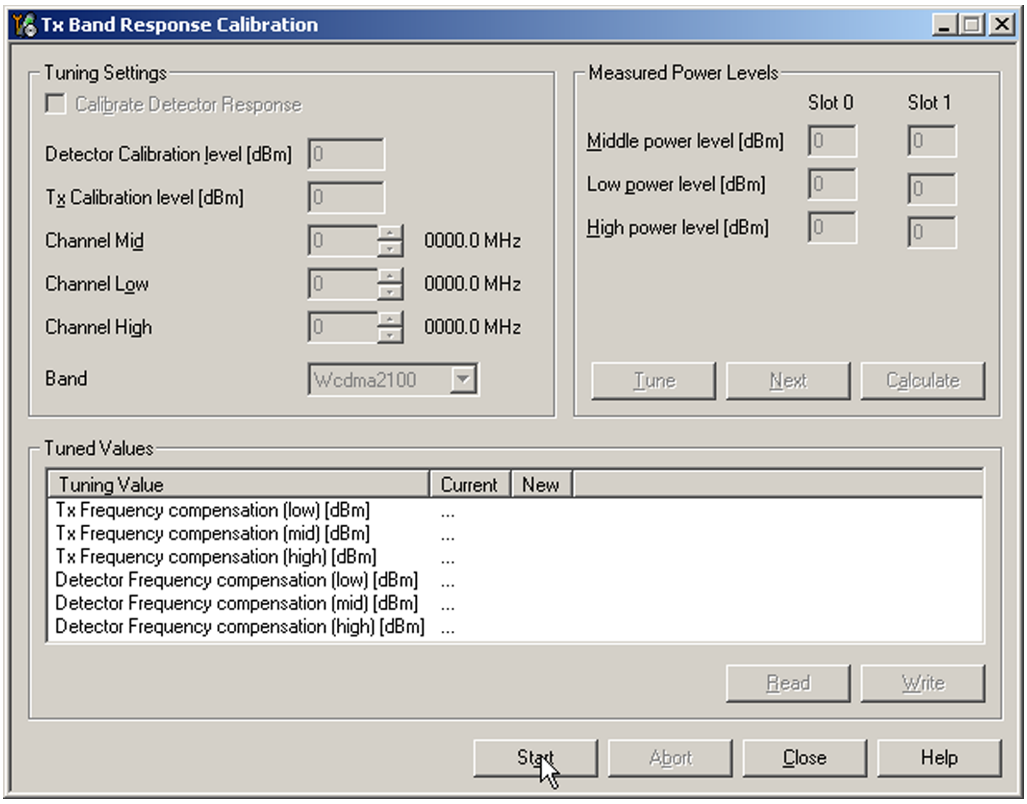
The purpose of this tuning operation is to calibrate the WCDMA Tx performance. It defines the power detector and Tx frequency compensation values. However, before starting this tuning procedure, it is necessary to carry out Tx AGC & Power Detector Calibration tuning. This is because its results will be needed for this tuning operation.

- In the *Tuning Settings* pane, it is possible to edit the numbers of channels used in this tuning operation.
- If the **Calibrate Detector Response** check box is checked, only Tx response is calibrated. Zero is written to the power detector compensation values block in the permanent memory (PM) of the terminal.
- **Detector Calibration level** shows the power level used for calibrating the power detector in this tuning procedure.
- **Tx Calibration level** shows the power level used for calibrating tx frequency in this tuning procedure.
- In the *Measured Power Levels* pane, you can insert the dBm values read from the power meter.
- In the *Tuned Values* pane, the values that are stored in the permanent memory (PM) of the terminal in Current columns are shown.
- New values are added to *New* column when the **Calculate** button is clicked.
- The **Abort** button aborts the tuning operation without saving the tuned values.
- The **Read** button reads the tuned values in the PM of the terminal, and displays them in the *Tuned Values* pane in in the *Current* column.

Steps

1. Start *Phoenix* service software.
2. Choose **File→Scan Product** .

3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→WCDMA→Tx Band Response Calibration** .
5. Click **Start**.


Tx Band Response Calibration
Tuning Settings
☐ Calibrate Detector Response
Detector Calibration level [dBm] 0
Tx Calibration level [dBm] 0
Channel Mid 0 0000.0 MHz
Channel Low 0 0000.0 MHz
Channel High 0 0000.0 MHz
Band Wcdma2100
Measured Power Levels
Slot 0
Slot 1
Middle power level [dBm] 0 0
Low power level [dBm] 0 0
High power level [dBm] 0 0
Tune
Next
Calculate
Tuned Values
Read
Write
Start
Abort
Close
Help

Tuning Value	Current	New
Tx Frequency compensation (low) [dBm]	...	
Tx Frequency compensation (mid) [dBm]	...	
Tx Frequency compensation (high) [dBm]	...	
Detector Frequency compensation (low) [dBm]	...	
Detector Frequency compensation (mid) [dBm]	...	
Detector Frequency compensation (high) [dBm]	...	

The current values are shown in the *Tuned Values* pane.

6. Click **Tune**.
7. Connect the power meter to the terminal, and set it to **Channel Mid** frequency.
8. Read the values of slot 0 and slot 1 from the power meter and enter them to **Middle power level** fields in the **Measured Power Levels** pane.

   Slot 0 is used for detector calibration and slot 1 for Tx calibration.
9. Click **Next**.
10. Switch the power meter to **Channel Low** frequency.
11. Read the values from the power meter, and enter them to **Low power level** fields.
12. Switch the power meter to **Channel High** frequency.
13. Read the values from the power meter, and enter them to **High power level** fields.
14. Click **Next**.
15. Click **Calculate**.

    The tuned values are shown in the *Tuned Values* pane in the *New* column.
16. Check that the tuned values are within the limits presented in the following table. If they are OK, click **Yes**.

	Min	Max
Tx Freq Comp (the first and last value)	-4	+4

17. To save the tuned values to the terminal, click **Write**.
18. Close the *Tx Band Response Calibration* window.

Tx LO leakage (WCDMA)

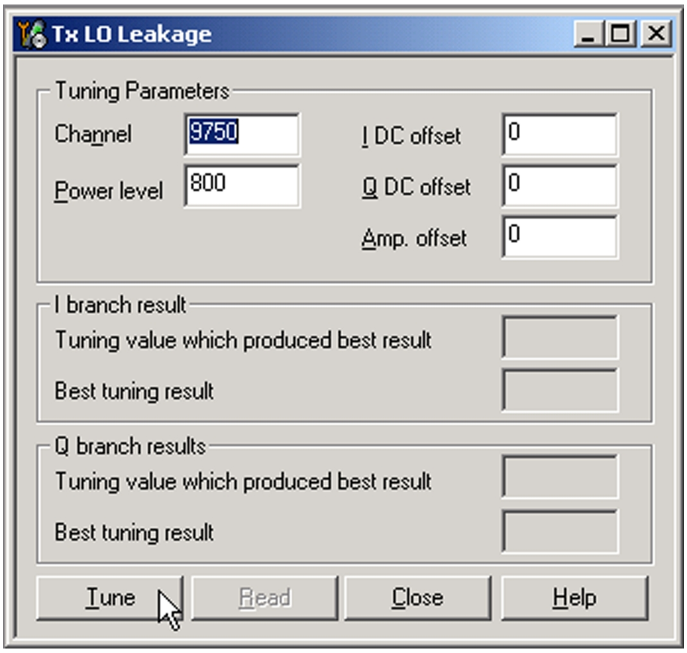
Context

The purpose of Tx LO leakage tuning is to minimize the carrier leakage of the IQ-modulator which is caused by the DC offset voltages in the Tx IQ-signal lines and in the actual IQ modulator.

The tuning improves WCDMA Tx AGC dynamics at low power levels. A self-calibration routine selects the best combination for internal control words in order to produce minimum LO leakage.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning**→**WCDMA**→ **Tx LO Leakage** .
3. Click **Tune**.



Channel: 9750
Power level: 800
I DC offset: 0
Q DC offset: 0
Amp. offset: 0

Tx LO Leakage
Tuning Parameters
I branch result
Tuning value which produced best result
Best tuning result
Q branch results
Tuning value which produced best result
Best tuning result
Tune
Read
Close
Help

4. To end the tuning, click **Close**.

6 — Camera Module Troubleshooting

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Table of Contents

Introduction to camera module troubleshooting 6–5
The effect of image taking conditions on image quality 6–6
Camera construction 6–12
[[[ERROR: No title available for <master_section>]]] 6–
Main camera construction 6–12
Front camera construction 6–13
Image quality analysis 6–13
Testing for dust in camera module 6–13
Testing camera image sharpness 6–14
Dirty camera lens protection window 6–15
Image bit errors 6–16
Camera viewfinder troubleshooting 6–17
Bad camera image quality troubleshooting 6–18
Main (back) camera troubleshooting 6–19
[[[ERROR: No title available for <master_section>]]] 6–
Camera baseband HW troubleshooting 6–20
Secondary (front) camera troubleshooting 6–21
[[[ERROR: No title available for <master_section>]]] 6–
Camera baseband HW troubleshooting 6–22
Flash LED troubleshooting 6–23
Introduction to flash LED troubleshooting 6–23
Flash LED and image taking conditions 6–23
Flash LED construction 6–28
Analysing image quality 6–28
Possible faults in image quality 6–28
Testing flash module functionality 6–28
Testing image colours with flash 6–29
Testing flash power 6–29
Camera flash LED troubleshooting 6–30
Indicator LED troubleshooting 6–31
Indicator LED construction 6–31
Camera indicator LED troubleshooting 6–32

List of Figures

Figure 65 Image blurred due to too close distance to target (5 cm) 6–6
Figure 66 Sharpness of picture is worse in edges than in center 6–7
Figure 67 Especially this type of images are affected much by lack of sharpness in edges / corners....6–7
Figure 68 Geometrical distortion 6–8
Figure 69 Handshake has caused blurring of this image. Note geometrical barrel distortion in background. 6–8
Figure 70 Near objects in image get skewed when shooting from a moving car 6–9
Figure 71 Noisy image taken in +70 degrees celsius 6–9
Figure 72 Image which has been taken "against light". The actual object is dark. 6–10
Figure 73 Flicker in image of white, uniform object illuminated by strong fluorescent light 6–10
Figure 74 A lens reflection effect caused by sun shining above the scene 6–11
Figure 75 A good picture taken indoors 6–11
Figure 76 A good picture taken outdoors 6–11
Figure 77 Camera module cross section and assembly principle 6–12
Figure 78 Main camera module bottom view including serial numbering 6–12

Figure 79 Front camera module cross section and assembly principle 6–13
Figure 80 Effects of dust on optical path 6–14
Figure 81 Image taken with clean protection window 6–15
Figure 82 Image taken with greasy protection window 6–15
Figure 83 Bit errors caused by JPEG compression 6–16
Figure 84 Example of a good quality image taken with the flash LED 6–23
Figure 85 overexposed image 6–24
Figure 86 Dark and noisy image 6–25
Figure 87 Shaken image 6–26
Figure 88 Camera white balance failure and overexposure 6–27
Figure 89 Color difference between flash colour limit samples 6–27
Figure 90 Mechanical construction and schematic of the flash LED module 6–28
Figure 91 Mechanical construction of the indicator LED 6–31

Introduction to camera module troubleshooting

Background, tools and terminology

Faults or complaints in camera operation can be roughly categorised into three subgroups:

1. Camera is not functional at all; no image can be taken.
2. Images can be taken but there is nothing recognizable in them.
3. Images can be taken and they are recognizable but for some reason the quality of images is seriously degraded.

Image quality is very hard to measure quantitatively, and even comparative measurements are difficult (comparing two images) to do, if the difference is small. Especially if the user is not satisfied with his/her device's image quality, and tells, for example, that the images are not sharp, it is fairly difficult to accurately test the device and get an exact figure which would tell whether the device is functioning properly.

Often subjective evaluation has to be used for finding out if a certain property of the camera is acceptable or not. Some training or experience of a correctly operating reference device may be needed in order to detect what actually is wrong.

It is easy for the user to take bad images in bad conditions. Therefore the camera operation has to be checked always in constant conditions (lighting, temperature) or by using a second, known-to-be good device as reference.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems may be expected to appear:

- Dust (black spots)
- Lack of sharpness
- Bit errors

Terms

Dynamic range	Camera's ability to capture details in dark and bright areas of the scene simultaneously.
Exposure time	Camera modules use silicon sensor to collect light and for forming an image. The imaging process roughly corresponds to traditional film photography, in which exposure time means the time during which the film is exposed to light coming through optics. Increasing the time will allow for more light hitting the film and thus results in brighter image. The operation principle is exactly the same with silicon sensor, but the shutter functionality is handled electronically i.e. there is no mechanical moving parts like in film cameras.
Flicker	Phenomenon, which is caused by pulsating in scene lighting, typically appearing as wide horizontal stripes in an image.
Noise	Variation of response between pixels with same level of input illumination.
Resolution	Usually the amount of pixels in the camera sensor; for example, RM-135 has a main camera with a resolution of 1600 x 1200 pixel and a secondary camera with a resolution of 384x320 pixel. In some occasions the term resolution is used for describing the sharpness of the images.

Sensitivity	Camera module's sensitivity to light. In equivalent illumination conditions, a less sensitive camera needs a longer exposure time to gather enough light in forming a good image. Analogous to ISO speed in photographic film.
Sharpness	Good quality images are 'sharp' or 'crisp', meaning that image details are well visible in the picture. However, certain issues, such as non-idealities in optics, cause image blurring, making objects in picture to appear 'soft'. Each camera type typically has its own level of performance.

The effect of image taking conditions on image quality

Distance to target

The lens in the module is specified to operate satisfactorily from 30cm to infinite distance of scene objects. In practice, the operation is such that close objects may be noticed to get more blurred when distance to them is shortened from 40cm. Lack of sharpness will be first visible in full resolution (VGA) images. If observing just the viewfinder, even very close objects may seem to appear sharp. This is normal behavior, do not change the camera module.

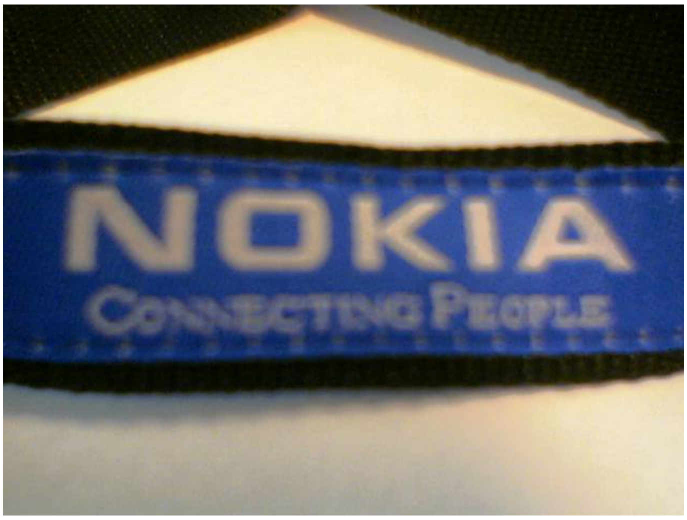


Figure 65 Image blurred due to too close distance to target (5 cm)

Sharpness of picture edges

Lens performance degrades in image edges, and generally the image is sharpest in center part. Particularly this applies to distant objects (> 1 meter). With near objects (about 5 cm – 30 cm) the lens behaves so that center of the image may not be the sharpest point, instead maximum sharpness is approximately in half way from center to edges. This phenomena can be seen particularly in images which have small details over the whole image area, such as grass or similar. See the figure below. This is normal behavior, do not change the camera module.

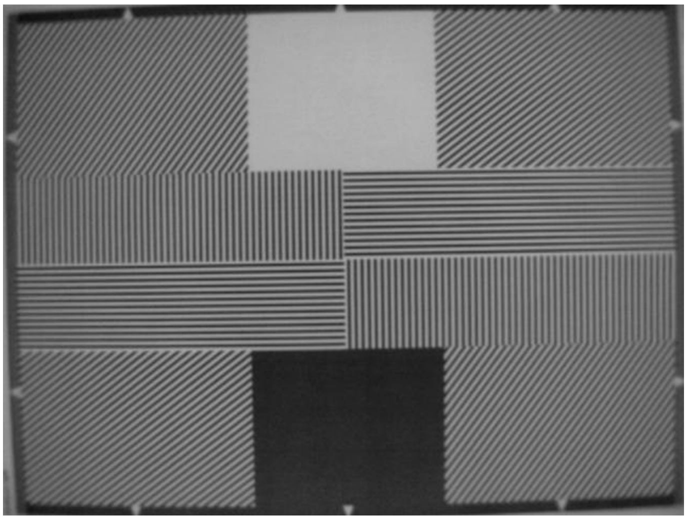


Figure 66 Sharpness of picture is worse in edges than in center

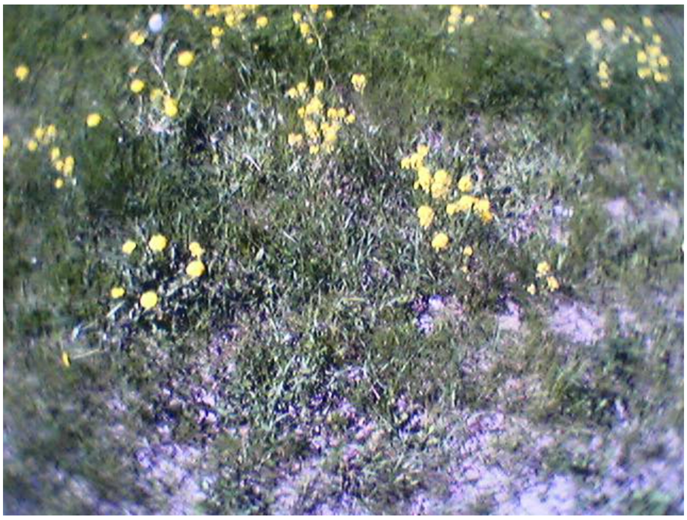


Figure 67 Especially this type of images are affected much by lack of sharpness in edges / corners

Geometrical distortion

Camera lens will cause some amount of so called barrel distortion in images. In practice, this appears as bending of straight objects in edges of the image. See the two figures below for an example. This is normal behavior, do not change the camera module.

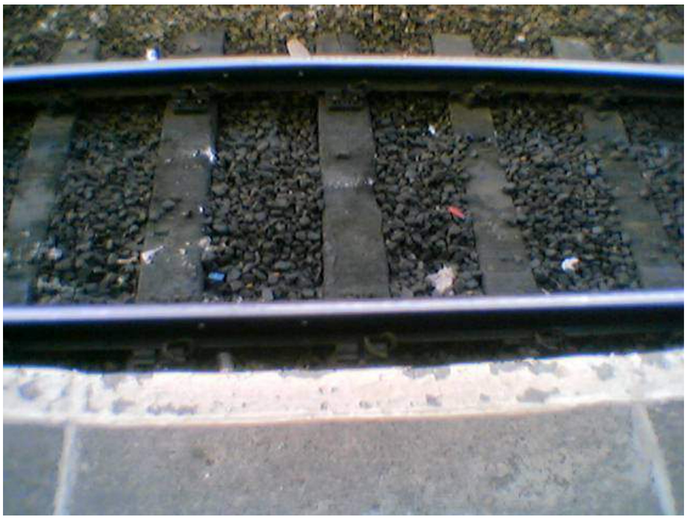


Figure 68 Geometrical distortion

Amount of light available

In dim conditions camera runs out of sensitivity. Exposure time is long (especially in night mode) and the risk of getting shaken (= blurred) images grows. Image noise level grows. The maximum exposure time in night mode is ¼ seconds, so images need to be taken with extreme care and by supporting the phone when the amount of light reflected from the target is low. Sometimes blurring may even happen at daytime if image is taken very carelessly. See the figure below for an example. This is normal behavior, do not change the camera module.

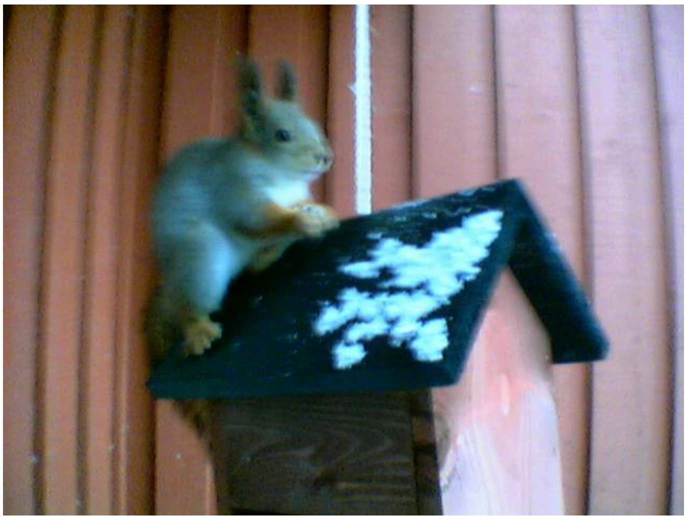


Figure 69 Handshake has caused blurring of this image. Note geometrical barrel distortion in background.

Movement in bright light

If pictures of moving objects are taken or if the device is used in a moving car, object 'skewing' or 'tilting' will occur. This phenomena is fundamental to most CMOS camera types and normal, and can not be helped. Movement of camera or object will usually cause blurring in inside or dim lighting conditions due to long exposure time. This is normal behavior, do not change the camera module.

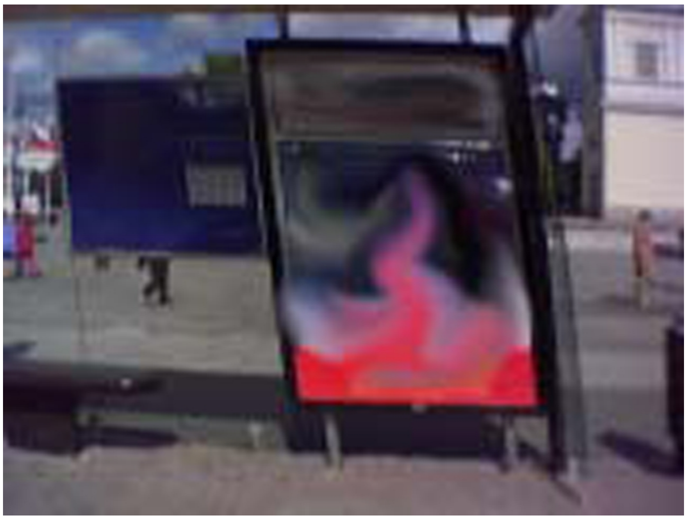


Figure 70 Near objects in image get skewed when shooting from a moving car

Temperature

High temperatures inside the mobile phone will cause more noise to appear in images, e.g. in +70 degrees of celsius the noise level may be very high, and it further grows if the conditions are dim. This is also normal to camera operation. This is normal behavior, do not change the camera module.

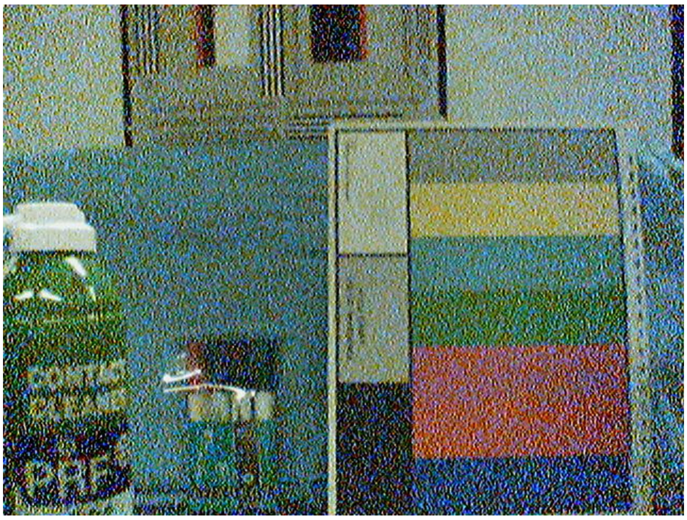


Figure 71 Noisy image taken in +70 degrees celsius

Phone display

If the display contrast is set too dark, the image quality degrades quite much: the images may be very dark, naturally depending on the setting. If display contrast is set too bright, image contrast appears bad and "faint". This flaw is easily cured by setting the display contrast to correct value. This is normal behavior, do not change the camera module.

Basic rules of photography, especially shooting against light

Electronic image sensors typically have much lower dynamic range than what films have. In practice this means that when taking a picture inside e.g. having a window behind object, will produce poor results. This is normal behavior, do not change the camera module.

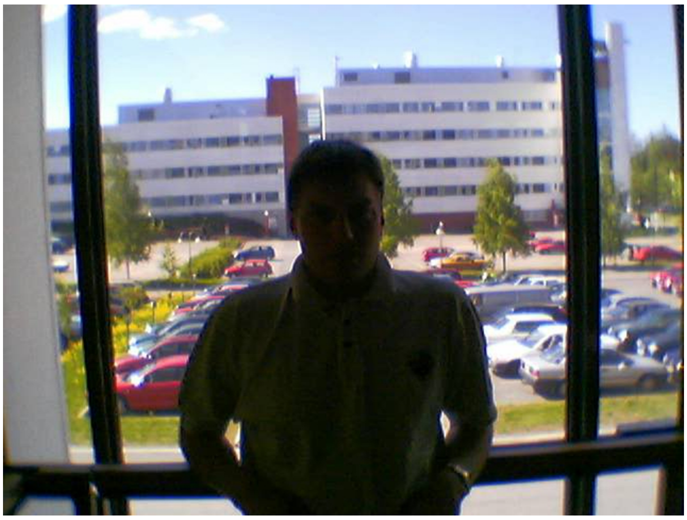


Figure 72 Image which has been taken "against light". The actual object is dark.

Flicker

In some occasions a bright fluorescent light may cause flicker to be seen in the viewfinder and captured image. This phenomena may also result if pictures are taken indoors under mismatch of 50/60 Hz electricity network frequency. The frequency will be detected from operator country sign information. In some very few countries, both 50 and 60 Hz networks are present and thus probability for the phenomena grows. This is normal behavior, do not change the camera module.

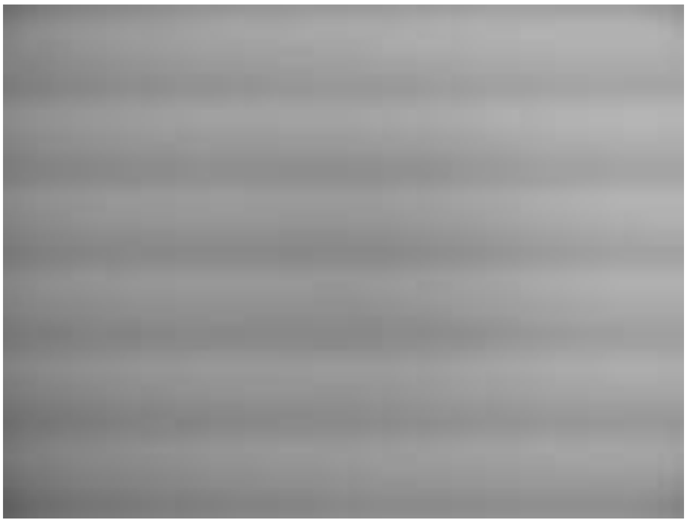


Figure 73 Flicker in image of white, uniform object illuminated by strong fluorescent light

Bright light outside of image view

Especially sun can cause clearly visible 'halo' effects and poor contrast in images. This happens due to unwanted reflections inside camera optics. Generally this kind of reflections are common in all optical systems. This is normal behavior, do not change the camera module.

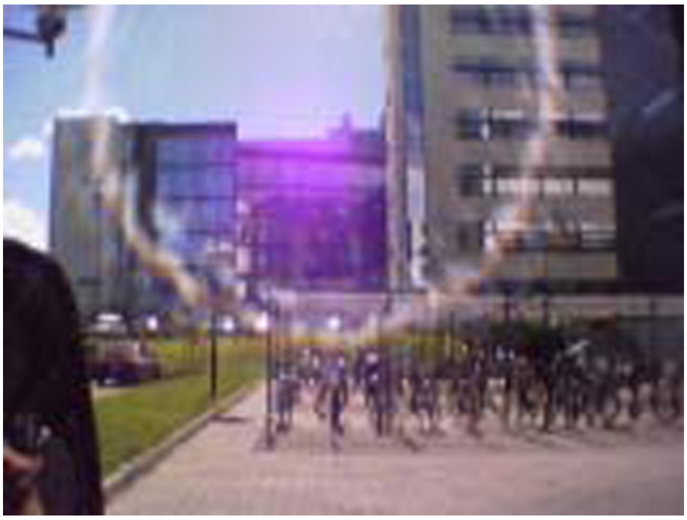


Figure 74 A lens reflection effect caused by sun shining above the scene

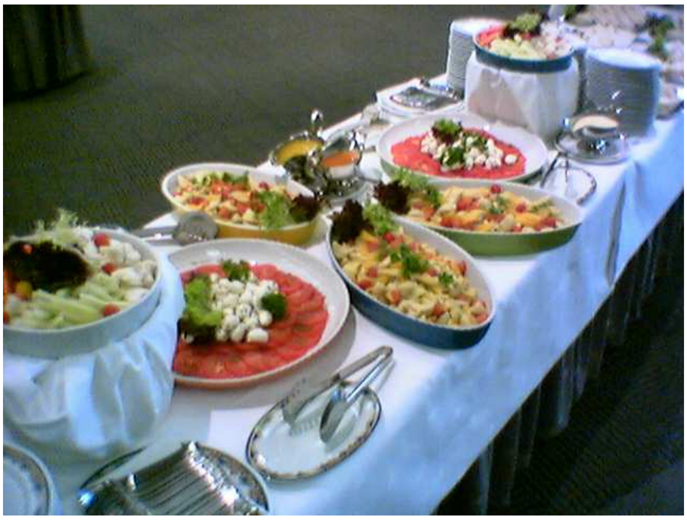


Figure 75 A good picture taken indoors

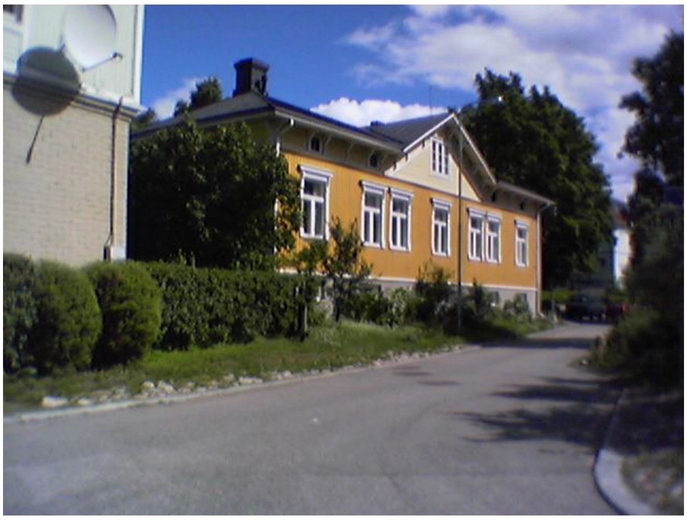


Figure 76 A good picture taken outdoors

Camera construction

This section describes the mechanical construction of both camera modules for getting a better understanding of the actual mechanical structure of each module.

Main camera construction

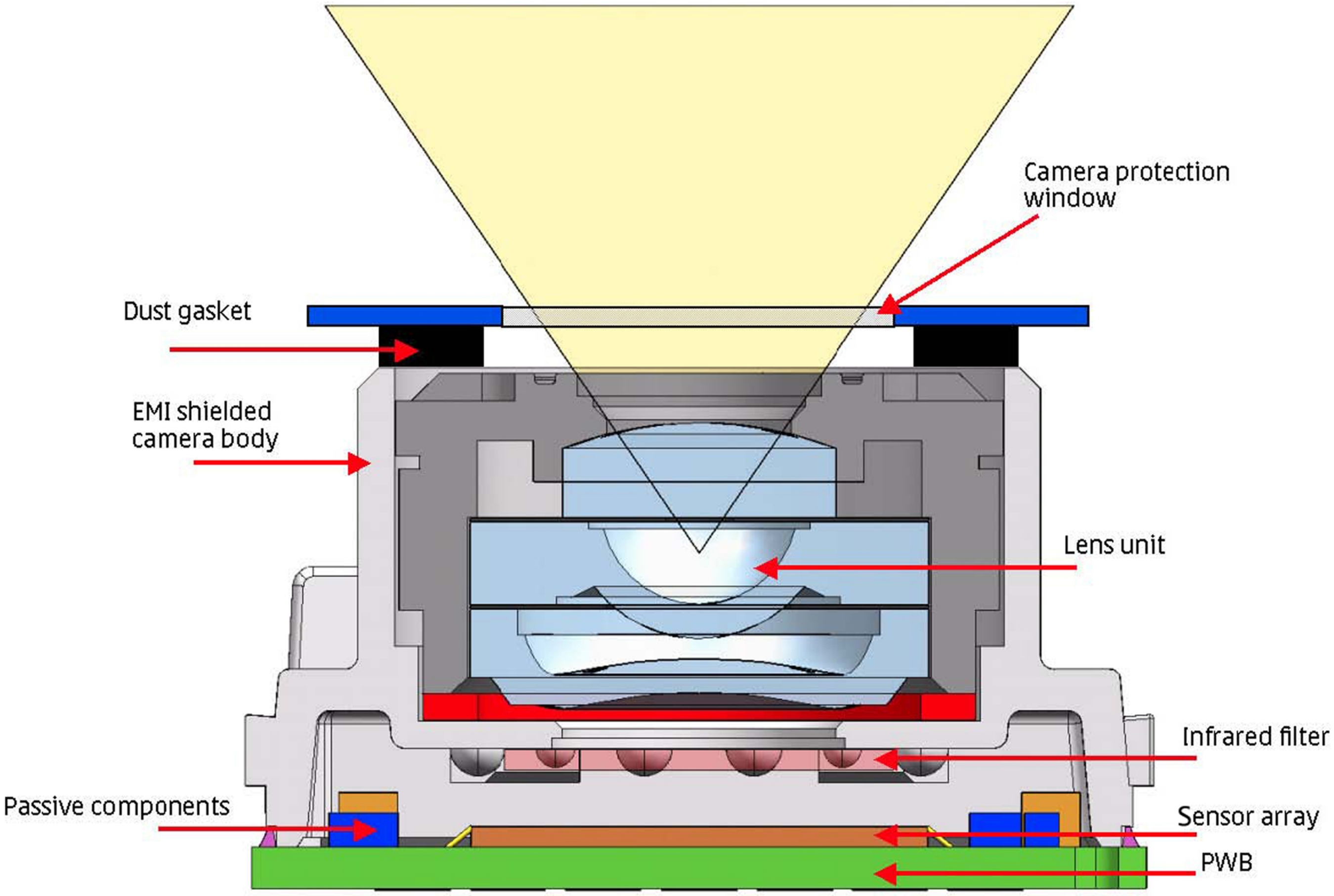

Camera protection window
Dust gasket
EMI shielded camera body
Lens unit
Infrared filter
Passive components
Sensor array
PWB

Figure 77 Camera module cross section and assembly principle

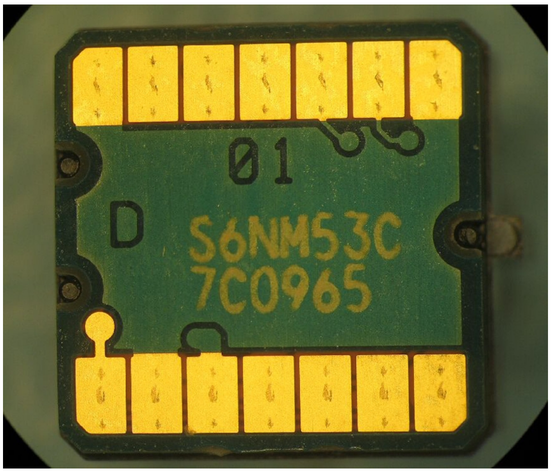

01
D
S6NM53C
7C0965

Figure 78 Main camera module bottom view including serial numbering

The camera module as a component is not a repairable part, meaning that the components inside the module may not be changed. Cleaning dust from the front face is allowed only. Use clean compressed air.

The camera module uses socket type connecting. For versioning, laser marked serial numbering is used on the PWB.

The main parts of the module are:

- Lens unit including lens aperture.
- Infrared filter; used to prevent infrared light from contaminating the image colors. The IR filter is glued to the EMI shielded camera body.
- Camera body; made of conductive metallized plastic and attached to the PWB with glue.
- Sensor array including DSP functions is glued and wire-bonded to the PWB.
- PWB, FR-4 type
- Socket type connection
- Laser-marked serial numbering on PWB (for versioning)
- Passive components
- Camera protection window; part of the phone cover mechanics
- Dust gasket between the lens unit and camera protection window

Front camera construction

The camera module as a component is not a repairable part because it is soldered on LID PWB. To exchange front camera module the whole LID PWB has to be exchanged. Cleaning dust from the front face is allowed only. Use clean compressed air.

The front camera module is constructed from 3 major components: lens unit, sensor and shield plate. The lens unit includes the lens holder, lens, aperture and IR-cut glass. Sensor is glued on lens holder. Both are covered with the shield plate. It also includes the module marking (1pin position).

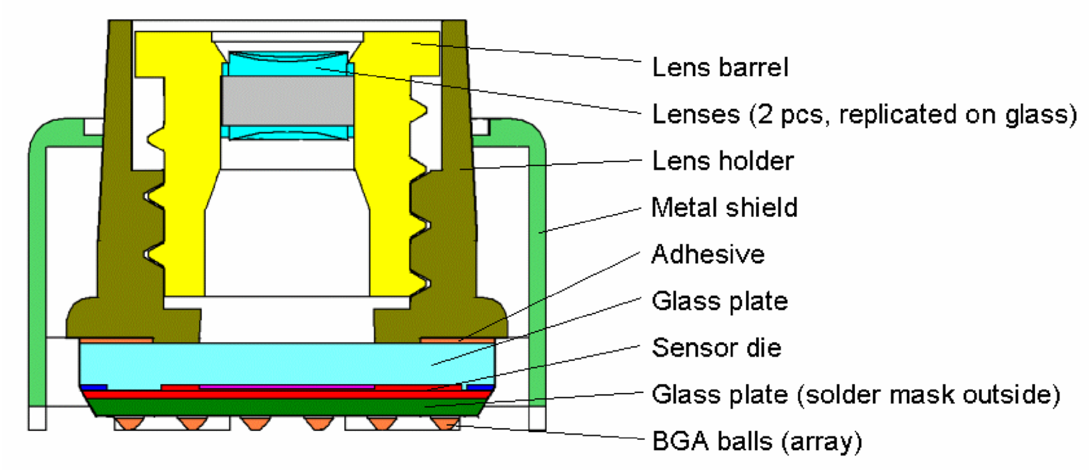


Figure 79 Front camera module cross section and assembly principle

Image quality analysis

Testing for dust in camera module

Symptoms and diagnosis

For detecting dust problems, take an image of a uniform white surface and analyse it in full resolution. A good quality PC CRT monitor is preferred for analysis (avoid using LCD). Search carefully because finding these defects is not always easy. Figure "Effects of dust on optical path" is an example of an image having easily detectable dust problems.

When taking a white image, use uniformly lightened white paper or white wall. Another option is to use uniform light but in this case make sure that the camera image is not flickering when taking the test image. In case flickering occurs, try to reduce the illumination level. Use JPEG image format for analysing, and set the image quality parameter to 'High Quality'.

Black spots in an image are caused by dirt particles trapped inside the optical system. Clearly visible and sharp edged black dots in an image are typically dust particles on the image sensor. These spots are searched for in the manufacturing phase, but it is possible that the camera body cavity contains a particle, which may move onto the image sensor active surface, for example, when the phone is dropped. Therefore it is also possible that the problem will disappear before the phone is brought to service. The camera should be replaced if the problem is present when the service technician analyses the phone.

If dust particles are lying on the infrared filter surface on either side, they are hard to locate because they are out of focus, and appear in the image as large, grayish and fading-edge 'blobs'. Sometimes they are invisible to the eye, and the user probably does not notice them at all. However, it is possible that a larger particle disturbs the user, causing need for service.

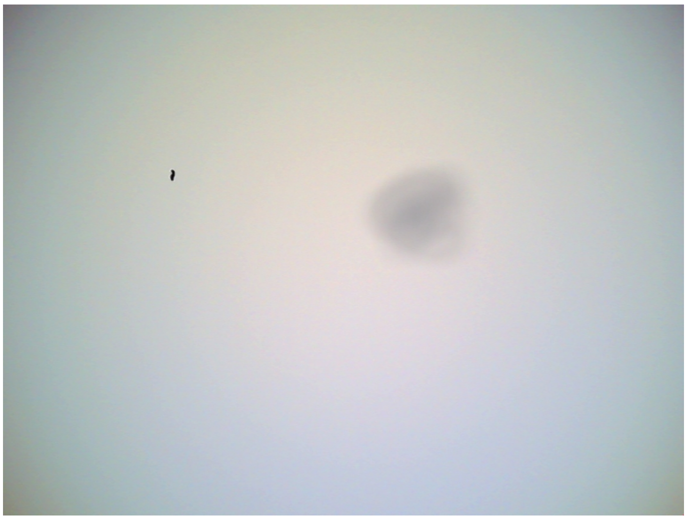


Figure 80 Effects of dust on optical path

If large dust particles get trapped on top of the lens surface in the cavity between the camera window and the lens, they will cause image blurring and poor contrast. If dust stays on the camera module surface, camera cussion, camera bezel or window at assembling, dust may sneak into the optical system as the optical zoom or Auto focus lens moves back and forth. The camera cussion and bezel between the window and the lens unit or camera module should prevent any particles from getting into the cavity after the manufacturing phase.

If dust particles are found on the sensor, this is classified as a manufacturing error of the module, and the camera should be replaced. Any particles inside the cavity between the protection window and the lens have most probably been trapped there in the assembly phase at a Nokia factory. Unauthorized disassembling of the product can also be the root of the problem. However, in most cases it should be possible to remove the particle(s) by using clean compressed air. Never wipe the lens surface before trying compressed air; the possibility of damaging the lens is substantial. Always check the image sharpness after removing dust.

Testing camera image sharpness

Symptoms and diagnosis

If pictures taken with a device are claimed to be blurry, there are six possible sources for the problem:

1 The protection window is fingerprinted, soiled, dirty, visibly scratched or broken.

2 The photographed object is too close – the camera lens operates with distances from 40 cm to infinity. This is no cause to replace camera module.

3 User has tried to take pictures in too dark conditions, and images are blurred due to handshake or movement. This is no cause to replace camera module.

4 There is dirt between the protection window and camera lens.

5 The protection window is defective. This can be either a manufacturing failure or caused by the user. The window should be changed.

6 The camera lens is misfocused because of a manufacturing error.

A quantitative analysis of sharpness is very difficult to conduct in any other environment than optics laboratory. Therefore, subjective analysis should be used.

If no visible defects (items 1-4) are found, a couple of test images should be taken. Generally, a well-illuminated typical indoor scene can be used as a target. The main considerations are:

- The protection window has to be clean.
- The amount of light (300 – 600 lux (bright office lighting)) is sufficient.
- The scene should contain, for example, small objects for checking sharpness. Their distance should be 1 – 2 meters.
- If possible, compare the image to another image of the same scene, taken with a different device. Note that the reference device has to be a similar Nokia phone.

Steps

1. Take several images of small objects in the distance of 1-2 metres.
2. Analyse the images on a PC screen at 100% scaling with the reference images.

   Pay attention to the computer display settings: at least 65000 colors (16-bit) have to be used. True colour (24-bit, 16 million colours) or 32-bit (full colour) setting is recommended.

Next actions

If there appears to be a clearly noticeable difference between the reference image and the test images, the module might have a misfocused lens -> change the module.

Re-check the resolution after changing the camera module.

If the changed module produces the same result, the fault is probably in the camera window. Check the window by looking carefully through it when replacing the module.

Dirty camera lens protection window

The following series of images demonstrates the effects of fingerprints on the camera protection window.

It should be noted that the effects of any dirt in images can vary much. It may be difficult to judge whether the window has been dirty or if something else is wrong. Therefore, the cleanness of the protection window should always be checked and the window should be wiped clean with a suitable cloth.

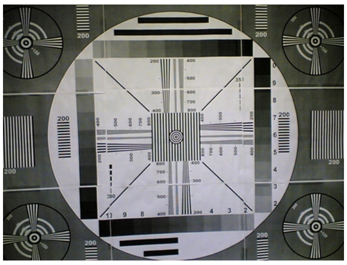


Figure 81 Image taken with clean protection window

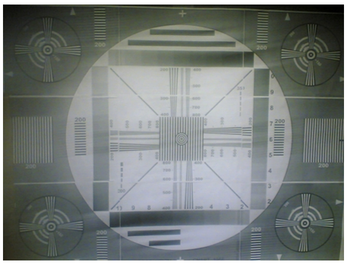


Figure 82 Image taken with greasy protection window

Image bit errors

Bit errors are image defects caused by data transmission errors between the camera module and the phone baseband and/or errors inside the module.

Usually bit errors can be easily detected in images, and they are best visible in full resolution images. A good practice is to use a uniform white test target when analysing these errors. The errors are clearly visible, colourful sharp dots or lines in camera images. See the following figure.

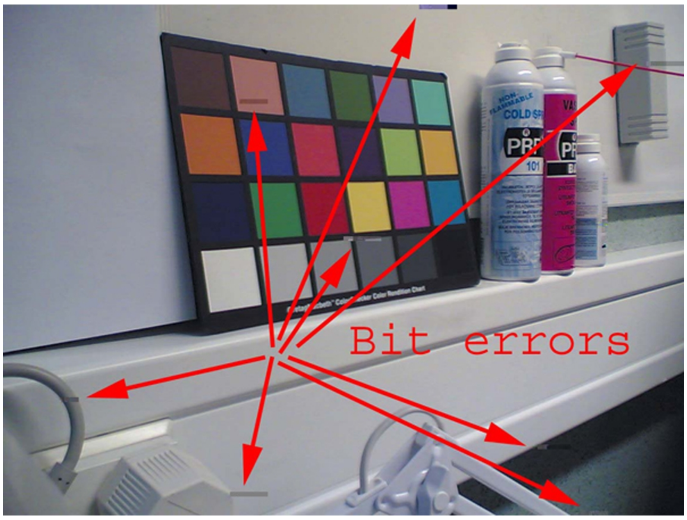


Figure 83 Bit errors caused by JPEG compression

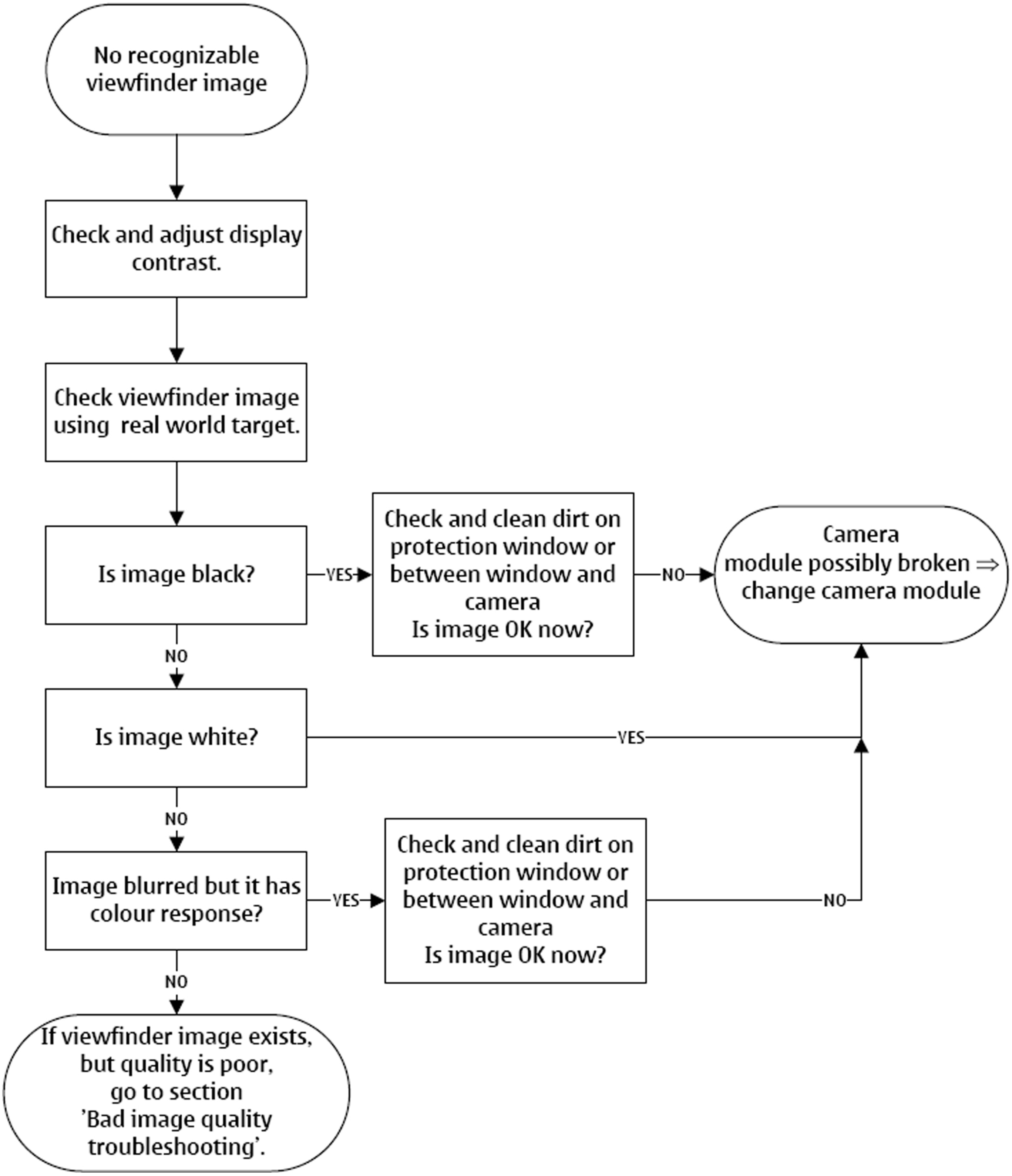
One type of bit error is a lack of bit depth. In this case, the image is almost totally black under normal conditions, and only senses something in very highly illuminated environments. Typically this is a contact problem between the camera module and the phone main PWB. You should check the camera assembly and connector contacts.

If the fault is in the camera module, bit errors are typically visible only when using some specific image resolution. For example, in case of a viewfinder fault, the error might exist but is not visible in a full size image.

> **Note:** At the most 5 clusters of black dots or blemish are not considered errors, and no reason to replace camera module

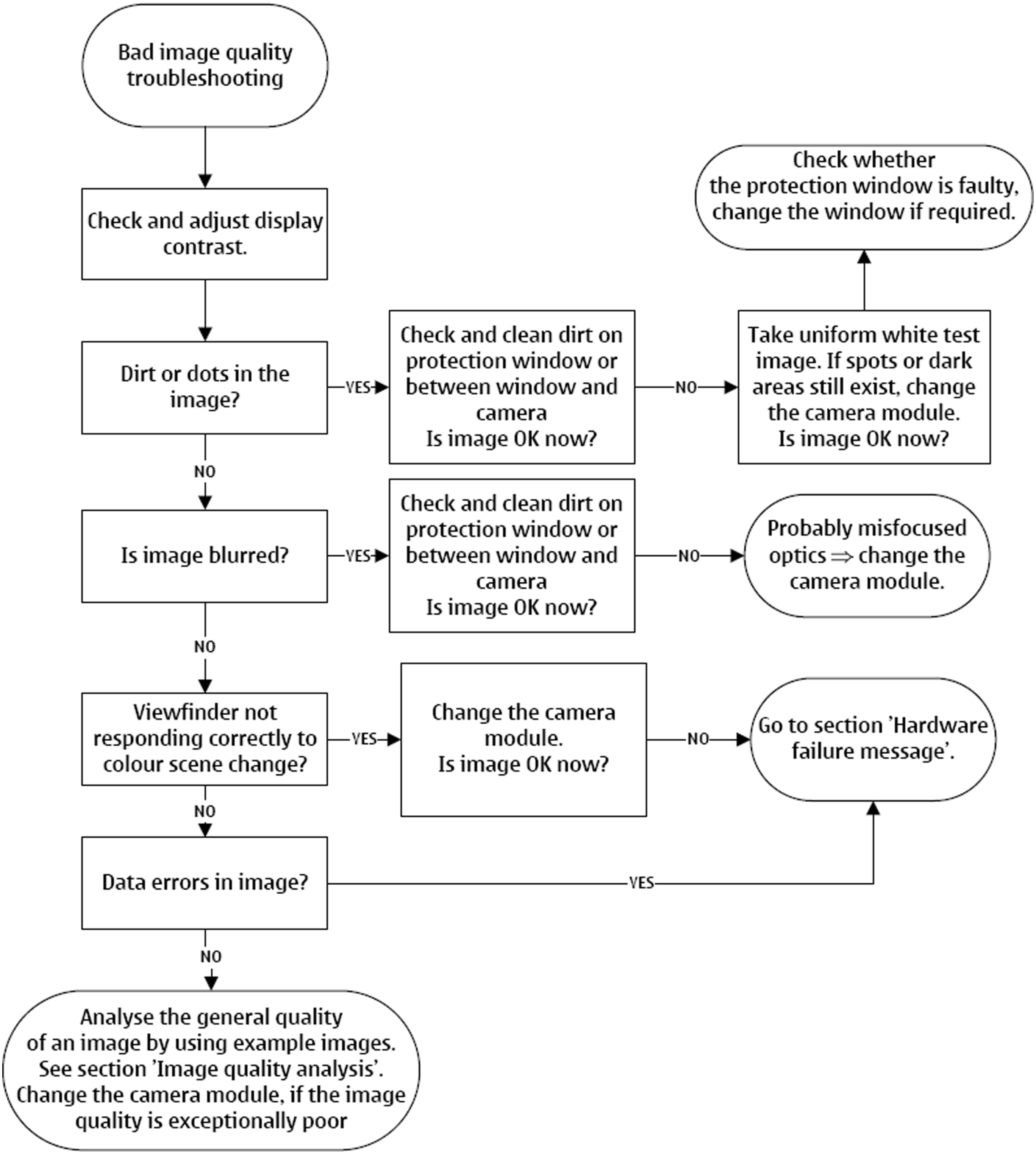
Camera viewfinder troubleshooting

Troubleshooting flow


No recognizable viewfinder image
Check and adjust display contrast.
Check viewfinder image using real world target.
Is image black?
YES
Check and clean dirt on protection window or between window and camera
Is image OK now?
NO
Camera module possibly broken ⇒ change camera module
NO
Is image white?
YES
NO
Image blurred but it has colour response?
YES
Check and clean dirt on protection window or between window and camera
Is image OK now?
NO
NO
If viewfinder image exists, but quality is poor, go to section 'Bad image quality troubleshooting'.

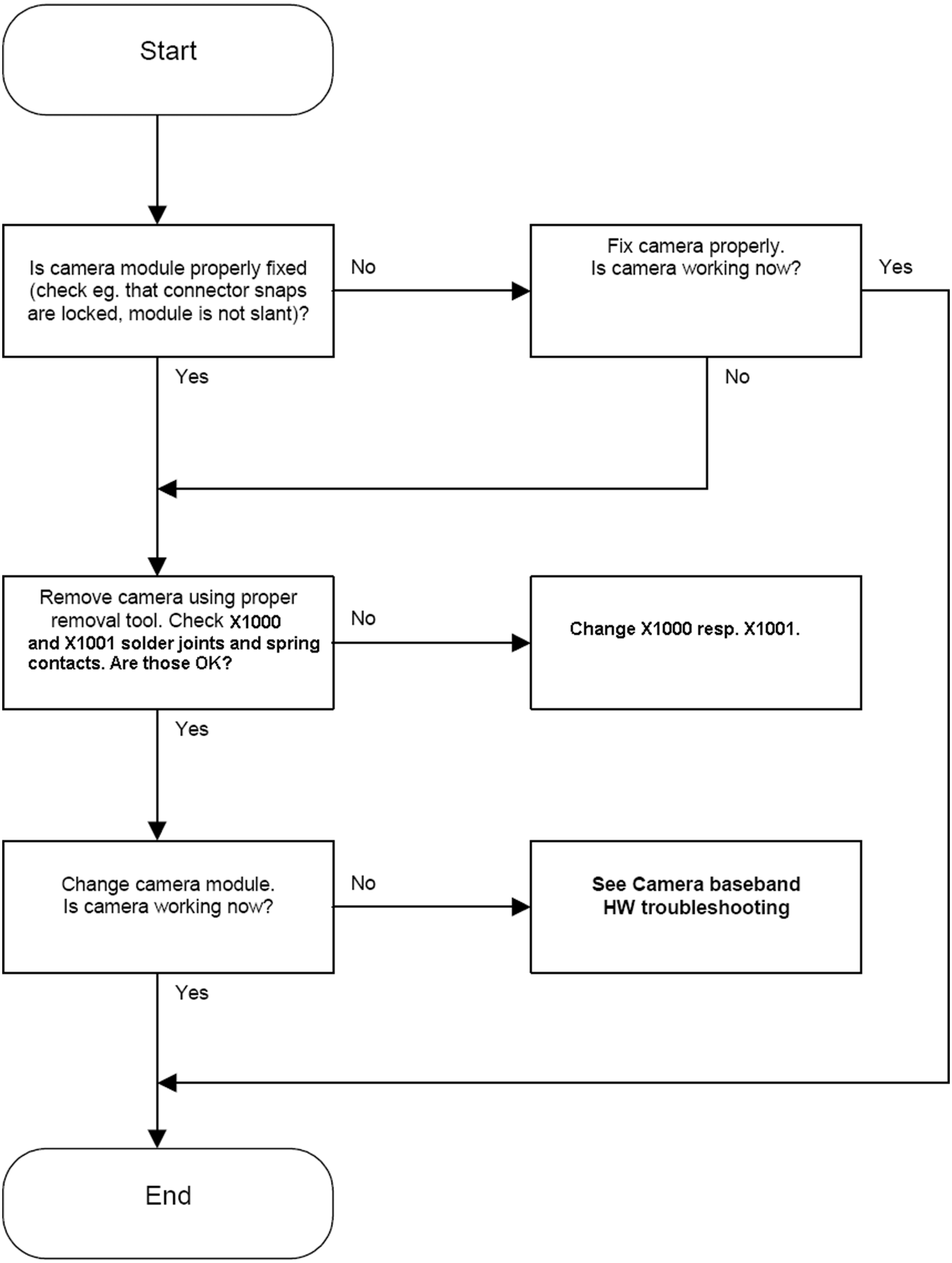
Bad camera image quality troubleshooting

Troubleshooting flow


Bad image quality troubleshooting
Check and adjust display contrast.
Dirt or dots in the image?
YES
Check and clean dirt on protection window or between window and camera
Is image OK now?
NO
Take uniform white test image. If spots or dark areas still exist, change the camera module.
Is image OK now?
Check whether the protection window is faulty, change the window if required.
NO
Is image blurred?
YES
Check and clean dirt on protection window or between window and camera
Is image OK now?
NO
Probably misfocused optics ⇒ change the camera module.
NO
Viewfinder not responding correctly to colour scene change?
YES
Change the camera module.
Is image OK now?
NO
Go to section 'Hardware failure message'.
NO
Data errors in image?
YES
NO
Analyse the general quality of an image by using example images. See section 'Image quality analysis'. Change the camera module, if the image quality is exceptionally poor

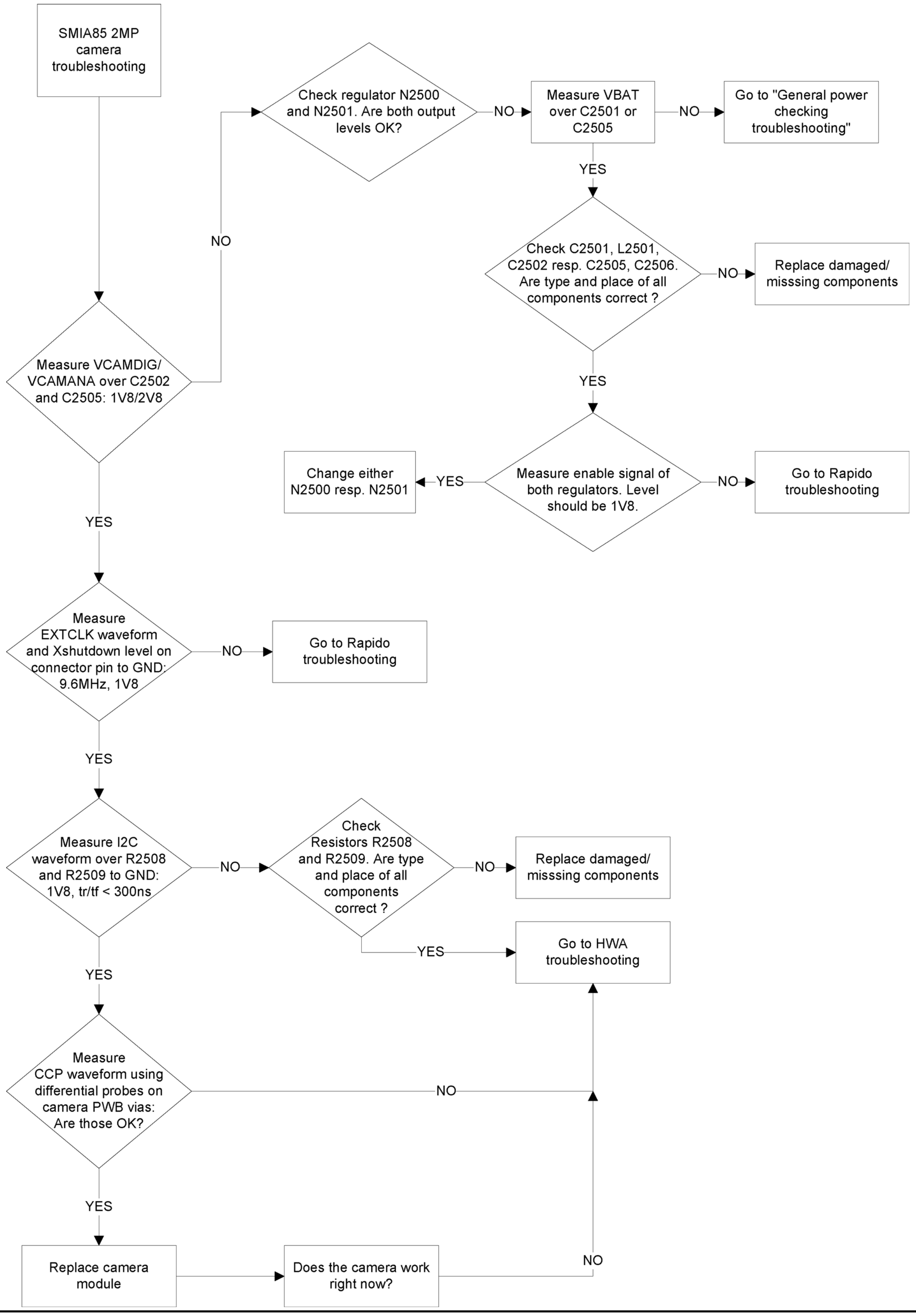
Main (back) camera troubleshooting

Troubleshooting flow


Start
Is camera module properly fixed (check eg. that connector snaps are locked, module is not slant)?
No
Fix camera properly.
Is camera working now?
Yes
Yes
No
Remove camera using proper removal tool. Check X1000 and X1001 solder joints and spring contacts. Are those OK?
No
Change X1000 resp. X1001.
Yes
Change camera module.
Is camera working now?
No
See Camera baseband HW troubleshooting
Yes
End

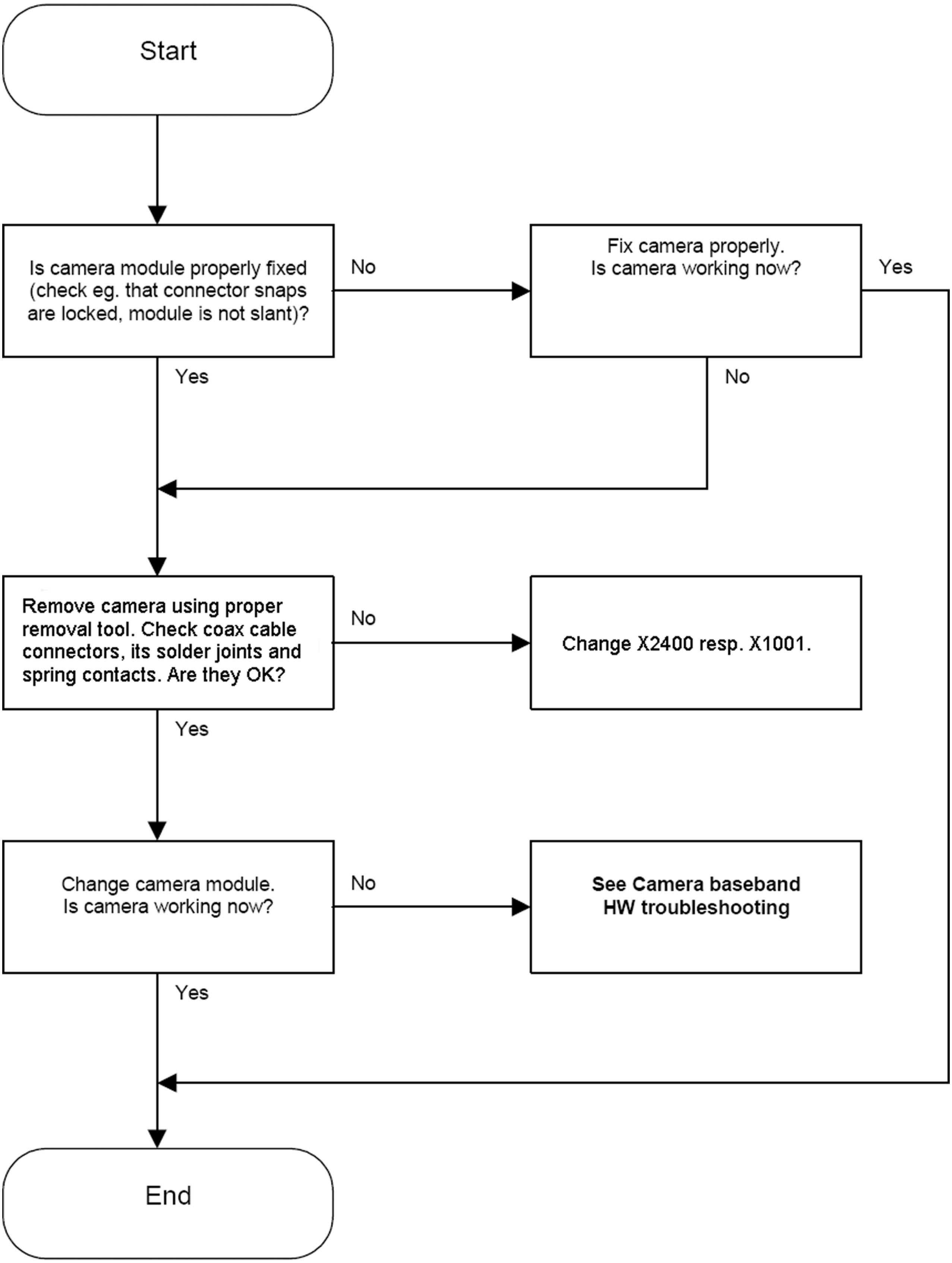
Camera baseband HW troubleshooting

Troubleshooting flow


SMIA85 2MP camera troubleshooting
Measure VCAMDIG/ VCAMANA over C2502 and C2505: 1V8/2V8
NO
Check regulator N2500 and N2501. Are both output levels OK?
NO
Measure VBAT over C2501 or C2505
NO
Go to "General power checking troubleshooting"
YES
Check C2501, L2501, C2502 resp. C2505, C2506. Are type and place of all components correct ?
NO
Replace damaged/ missing components
YES
Measure enable signal of both regulators. Level should be 1V8.
YES
Change either N2500 resp. N2501
NO
Go to Rapido troubleshooting
YES
Measure EXTCLK waveform and Xshutdown level on connector pin to GND: 9.6MHz, 1V8
NO
Go to Rapido troubleshooting
YES
Measure I2C waveform over R2508 and R2509 to GND: 1V8, tr/tf < 300ns
NO
Check Resistors R2508 and R2509. Are type and place of all components correct ?
NO
Replace damaged/ missing components
YES
Go to HWA troubleshooting
YES
Measure CCP waveform using differential probes on camera PWB vias: Are those OK?
NO
YES
Replace camera module
Does the camera work right now?
NO

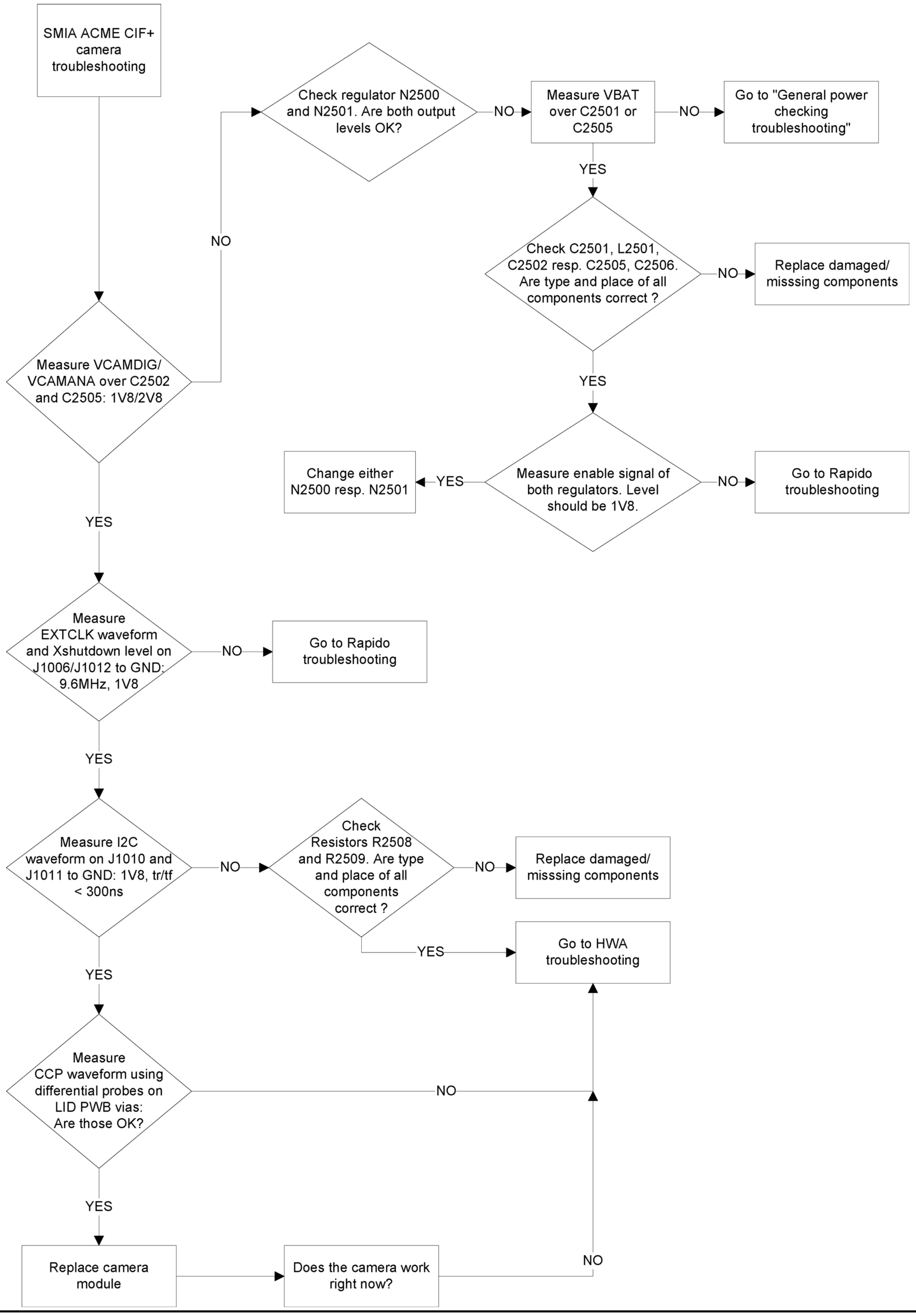
Secondary (front) camera troubleshooting

Troubleshooting flow


Start
Is camera module properly fixed (check eg. that connector snaps are locked, module is not slant)?
No
Fix camera properly. Is camera working now?
Yes
Yes
No
Remove camera using proper removal tool. Check coax cable connectors, its solder joints and spring contacts. Are they OK?
No
Change X2400 resp. X1001.
Yes
Change camera module. Is camera working now?
No
See Camera baseband HW troubleshooting
Yes
End

Camera baseband HW troubleshooting

Troubleshooting flow


SMIA ACME CIF+ camera troubleshooting
Measure VCAMDIG/ VCAMANA over C2502 and C2505: 1V8/2V8
NO
Check regulator N2500 and N2501. Are both output levels OK?
NO
Measure VBAT over C2501 or C2505
NO
Go to "General power checking troubleshooting"
YES
Check C2501, L2501, C2502 resp. C2505, C2506. Are type and place of all components correct ?
NO
Replace damaged/ missing components
YES
Measure enable signal of both regulators. Level should be 1V8.
YES
Change either N2500 resp. N2501
NO
Go to Rapido troubleshooting
YES
Measure EXTCLK waveform and Xshutdown level on J1006/J1012 to GND: 9.6MHz, 1V8
NO
Go to Rapido troubleshooting
YES
Measure I2C waveform on J1010 and J1011 to GND: 1V8, tr/tf < 300ns
NO
Check Resistors R2508 and R2509. Are type and place of all components correct ?
NO
Replace damaged/ missing components
YES
Go to HWA troubleshooting
YES
Measure CCP waveform using differential probes on LID PWB vias: Are those OK?
NO
YES
Replace camera module
Does the camera work right now?
NO

Flash LED troubleshooting

Introduction to flash LED troubleshooting

A fault or complaint associated to LED flash operation can be roughly categorized into two subgroups:

1. Flash is not functional at all (no light output at all).
2. Images can be taken and they are recognizable but for some reason the quality of images is degraded.

   Examples of quality degradations:

   - Brightness is not sufficient.
   - Brightness is too much = overexposed.
   - Only portions of the image brightness (e.g., left, right, top or bottom) are proper and the rest are not.

The quality of an image is very difficult to measure quantitatively, and even comparative measurements are difficult (comparing two images), if the difference between reference images is small. If a user is not satisfied with his/her device's image quality, it is fairly difficult to accurately test the device and get an exact result, which would tell if the device is working properly.

Often subjective evaluation has to be used for finding out if there is something wrong in the flash. Some training or experience of a correctly operating reference device may be needed in order to detect possible faults. It is easy for a user to take low quality images in bad conditions. Therefore, the camera and flash operation has to be always checked in constant conditions (lighting, temperature) or by using a second, known-to-be good reference device.

Flash LED and image taking conditions

This section describes some of common factors, which may cause poor image quality if not taken into account by end users when taking pictures, and may therefore result in complaints. The items described are normal to the camera and LED flash operation and do not raise a need for servicing the components.

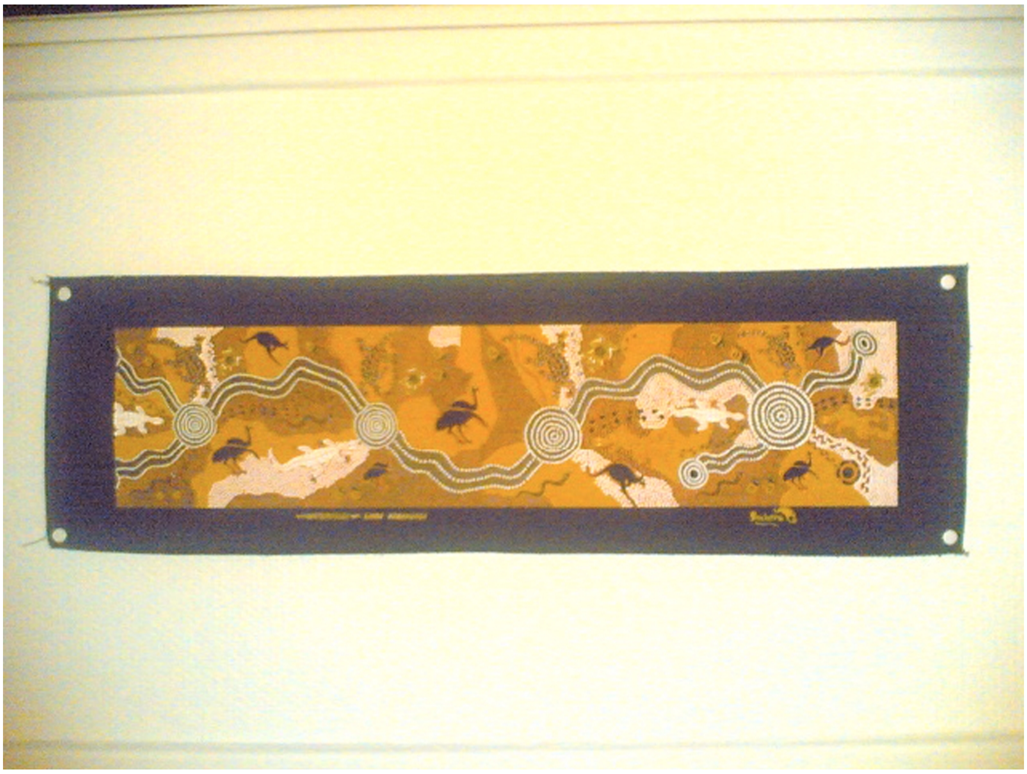


Figure 84 Example of a good quality image taken with the flash LED

Distance to the target (too close)

There is no feedback in the flash system, which means that the light output is constant in every situation. This causes the images to overexposure, when shot from close distance. The flash LED is designed to work optimally between distances of 70 cm – 1.2 m.

This is normal behaviour; do not change the flash module.

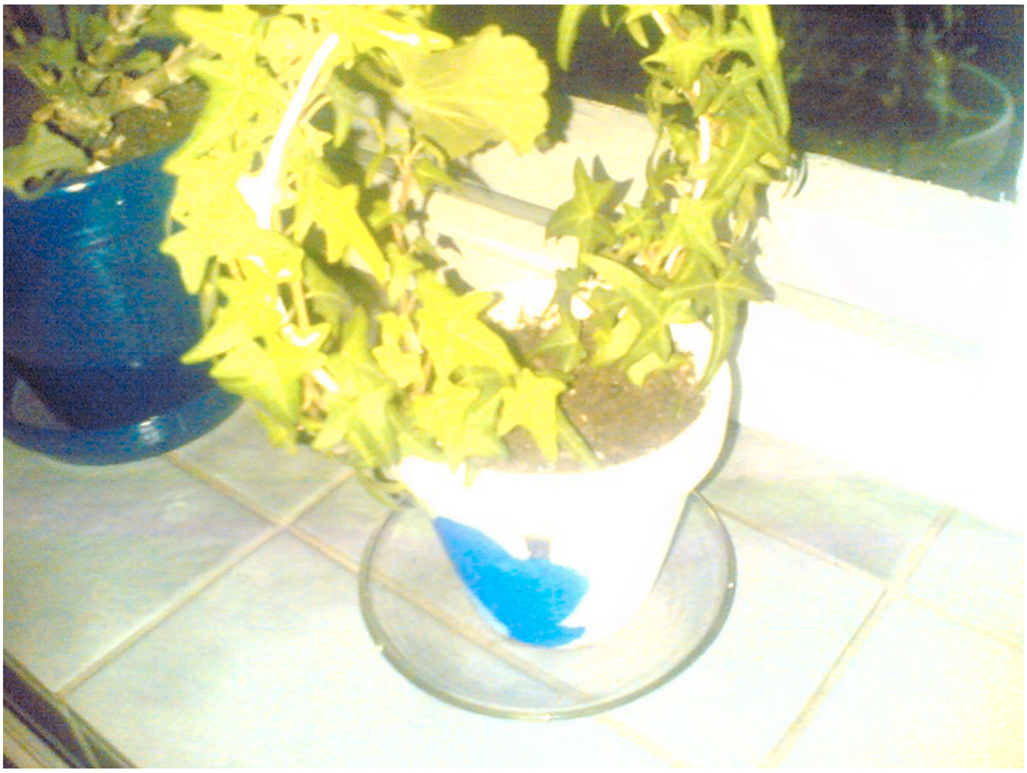


Figure 85 overexposed image

Distance to the target (too far away):

The power of the white LED flash is still very modest compared to xenon flash technology. Even with full power, the maximum distance for an acceptable image quality is roughly 1.2 m. If the distance is greater than 1.2 m, the images will appear dark and the noise level increases.

This is normal behaviour; do not change the flash module.

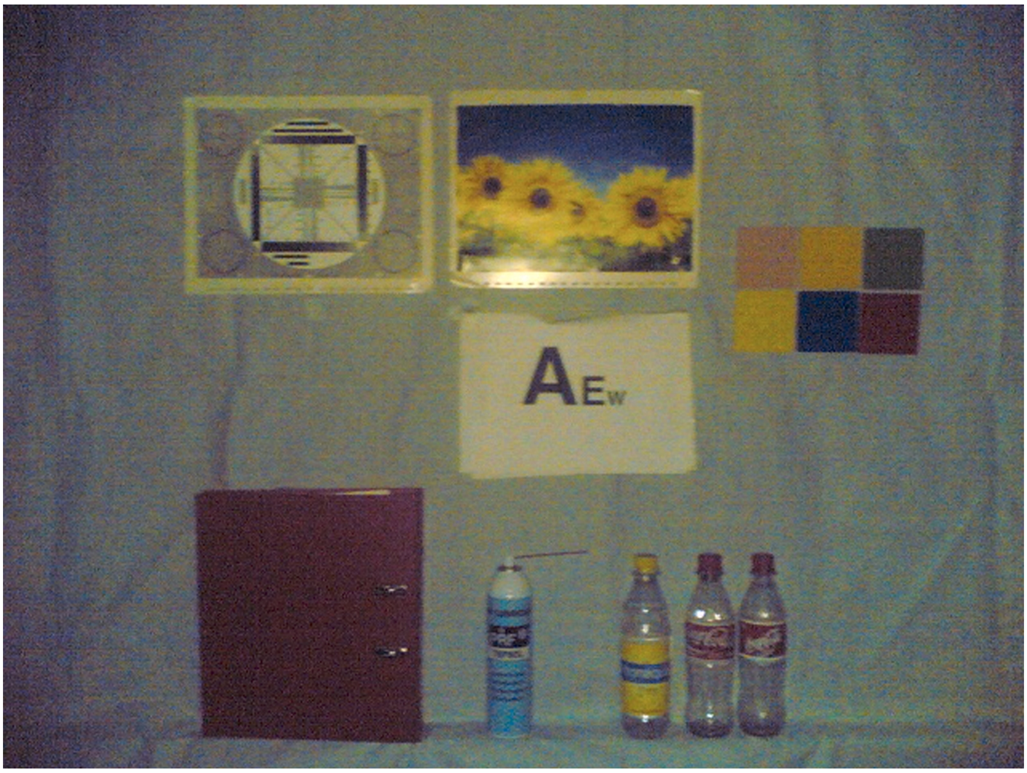


Figure 86 Dark and noisy image

Shaken (= blurred) images

The traditional xenon flash has the advantage of stopping the movement. This is a result of an extremely short and intense light pulse, which makes it possible for a camera to use very short exposure time. Due to the weak output of the LED flash, the exposure time has to be actually increased in the viewfinder mode in total blackness, instead of shortening it. This allows the sensor to integrate longer and collect more light but this also easily creates blurred images if care is not taken.

In addition to the limitation due to small LED flash light, handshake owing to camcoder type product concept and shutter button operation exists. These are not errors but a limitation of the product. No need to change the LED flash module.

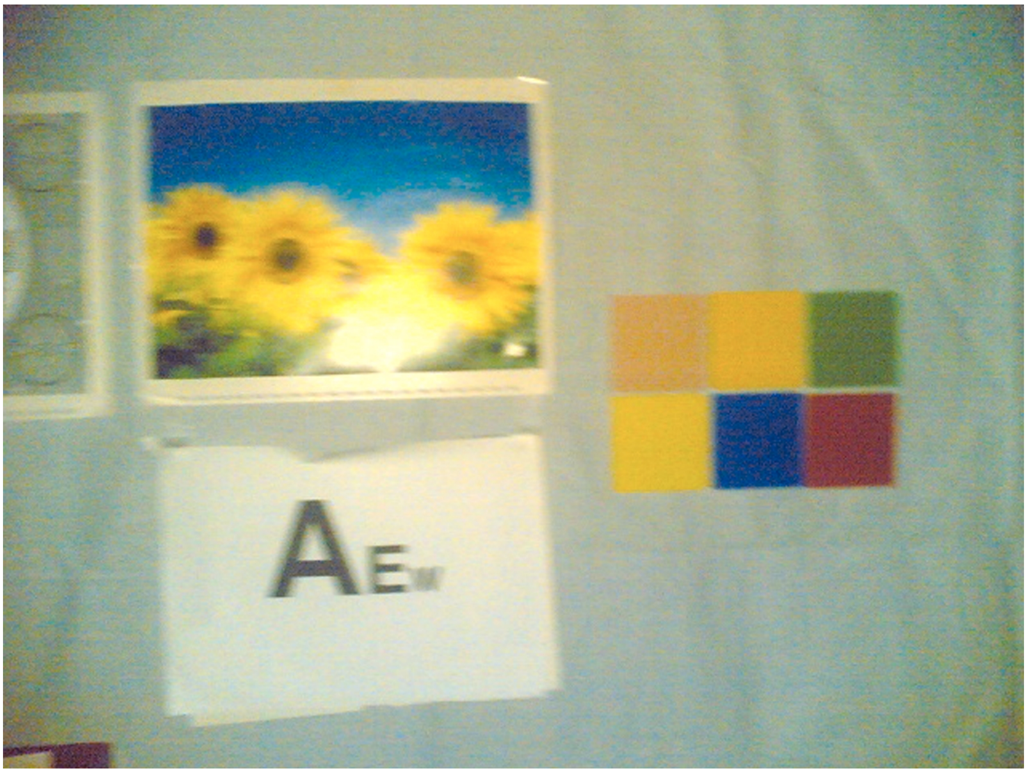


Figure 87 Shaken image

Camera white balance failure and overexposure due to presence of ambient light

Because the spectral output of the flash is known, the white balance and the exposure control of the camera work in optimal way with the flash in total blackness. This is why some of the pictures may fail (i.e. images get a bit yellow or reddish, or greenish or bluish, depending on the ambient light characteristics, as well as overexposed or underexposed).

If the flash works correctly in dark conditions, there is no need to change the flash module.

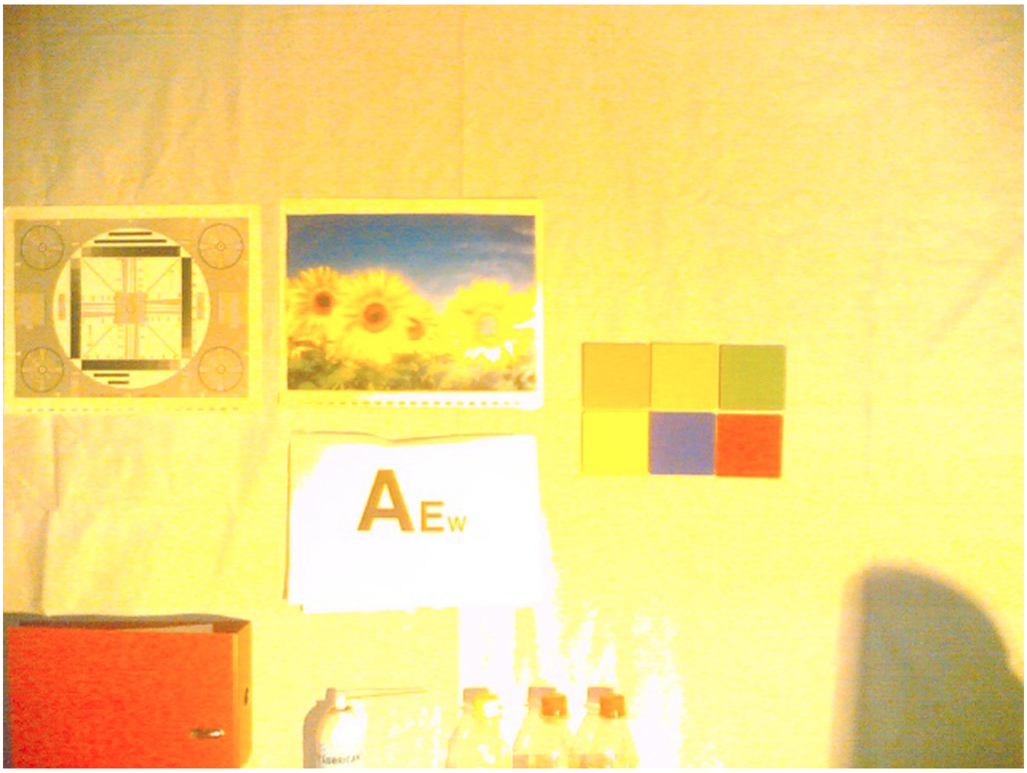


Figure 88 Camera white balance failure and overexposure

Colour difference between different modules

There is some variation in the spectrum of the flash, which derives from the manufacturing process of the white LEDs. Because of this variation, there may be some variation in the colour of the images as well.

This is normal behaviour; do not change the flash module.

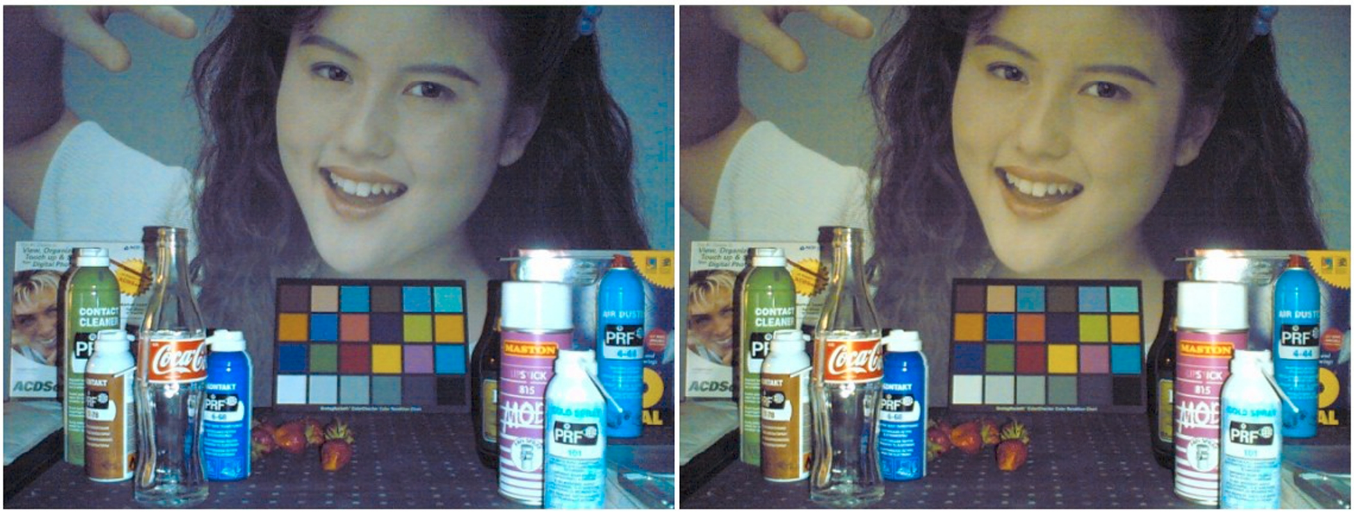


Figure 89 Color difference between flash colour limit samples

Flash LED construction

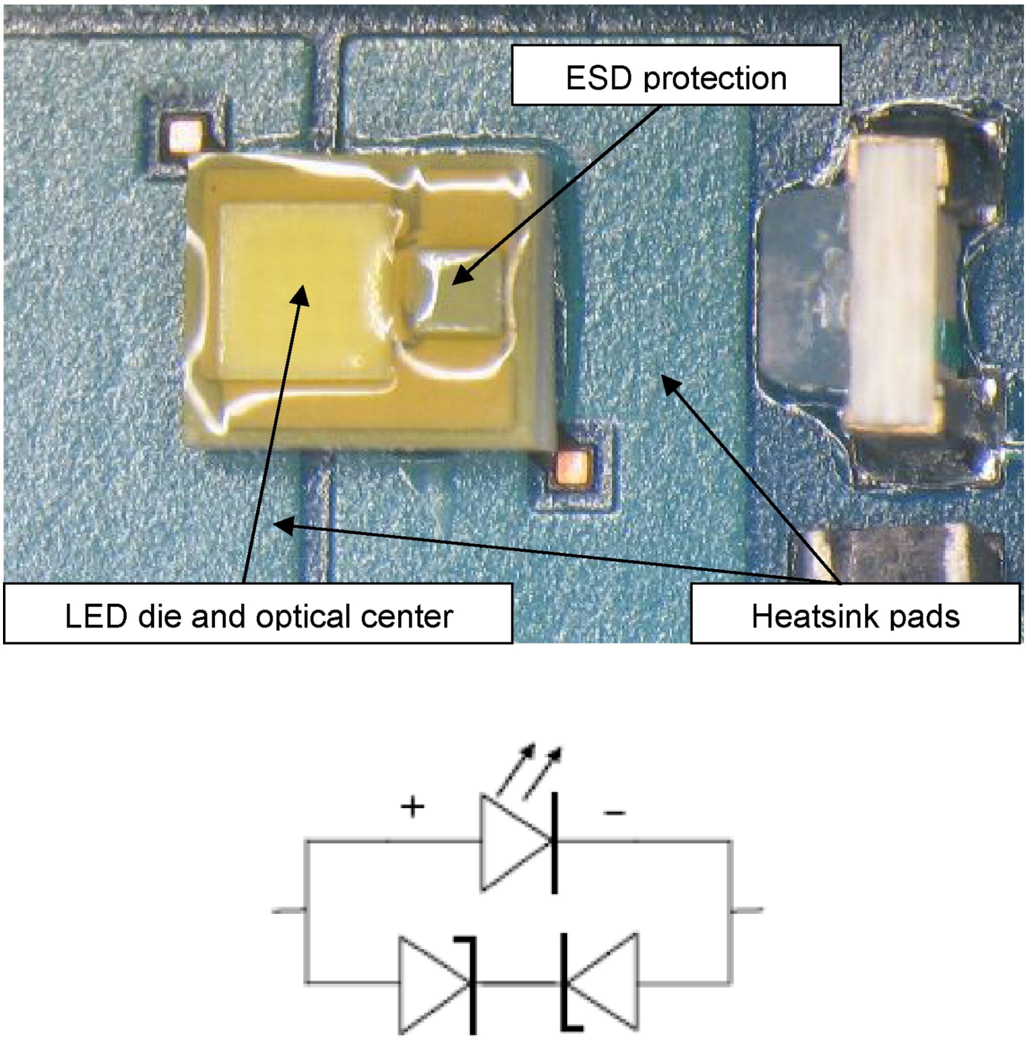


Figure 90 Mechanical construction and schematic of the flash LED module

Analysing image quality

Possible faults in image quality

When checking for possible errors in the flash functionality, knowing what error is suspected, significantly helps the testing by narrowing down the number of possible test cases. The following types of image quality problems may be expected to appear:

- LED module is not flashing at all
- Image colours are not good
- Flash power is weak

Testing flash module functionality

Context

With the help of this test you can check the flash module's overall functionality.

Always set the flash to FORCED FLASH mode when performing the test. The FORCED FLASH mode enforces the LED module to flash, even if there is some ambient light present.

Steps

1. Take an image with the flash and monitor at same time whether the LED module flashes.

Results

If the LED flashes normally, the overall functionality of the module is OK.

Testing image colours with flash

Context

With the help of this test you can check if the image colours are normal when using the flash.

Steps

1. Take an image of a target, which contains something white in total blackness from less than 1 m range.

Results

If the white target appears to be white, the flash is working correctly. However, remember that there is some variation in the flash colour from module to module.

Testing flash power

Context

With the help of this test you can check if the flash is working with adequate power level.

Steps

1. Take an image with the flash in total blackness (ambient light <1 lux) of a target 80 cm - 1 m away.

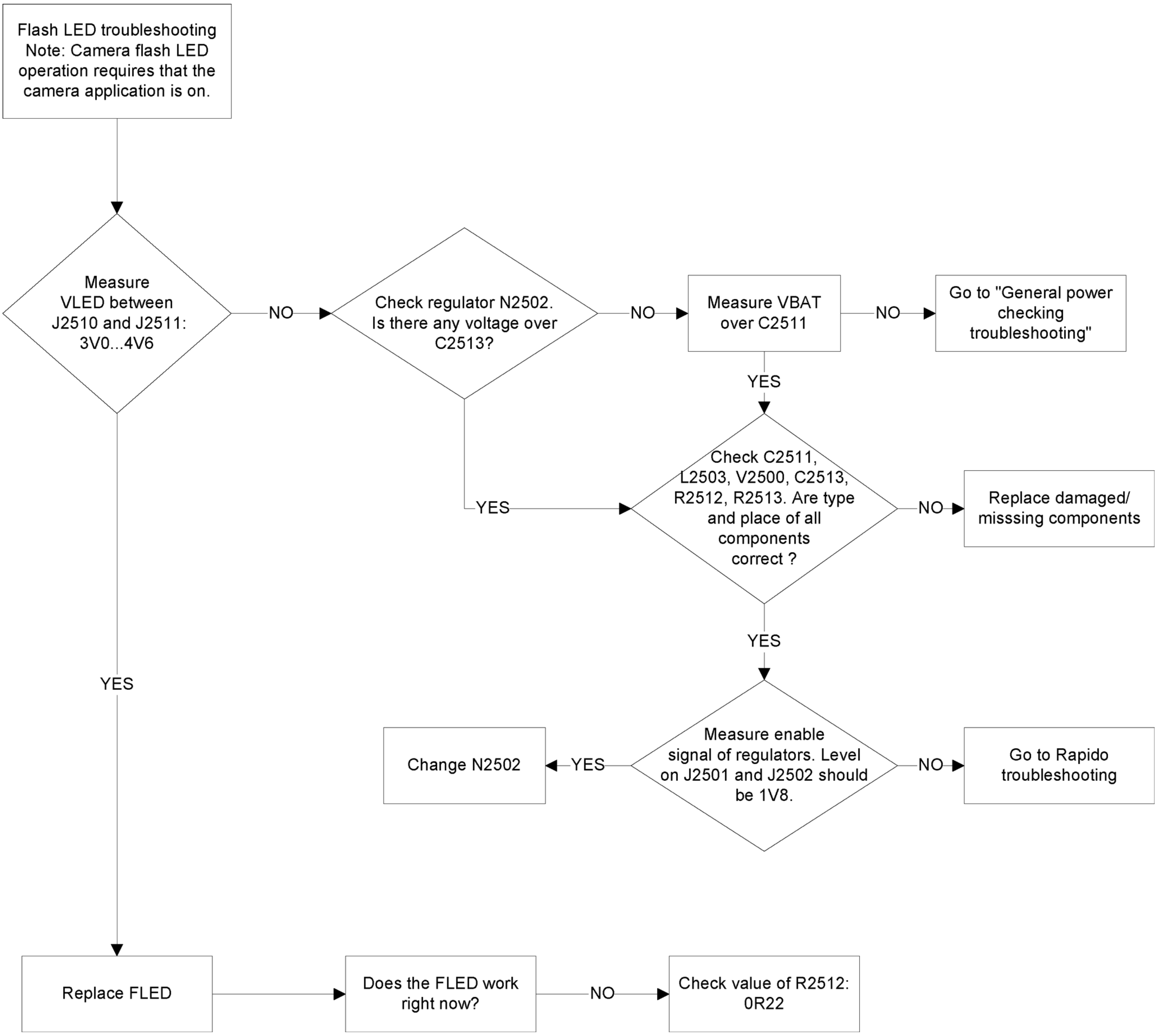
Results

If the flash is working normally with adequate power level, the image is correctly exposed between distances 80 cm to 1 m.

Remember that the brightness level in the corners is always less than in the center of the image because of camera and flash optics.

Camera flash LED troubleshooting

Troubleshooting flow


Flash LED troubleshooting
Note: Camera flash LED operation requires that the camera application is on.
Measure VLED between J2510 and J2511: 3V0...4V6
NO
Check regulator N2502. Is there any voltage over C2513?
NO
Measure VBAT over C2511
NO
Go to "General power checking troubleshooting"
YES
Check C2511, L2503, V2500, C2513, R2512, R2513. Are type and place of all components correct ?
NO
Replace damaged/ misssing components
YES
YES
Measure enable signal of regulators. Level on J2501 and J2502 should be 1V8.
YES
Change N2502
NO
Go to Rapido troubleshooting
YES
Replace FLED
Does the FLED work right now?
NO
Check value of R2512: 0R22

Indicator LED troubleshooting

Indicator LED construction

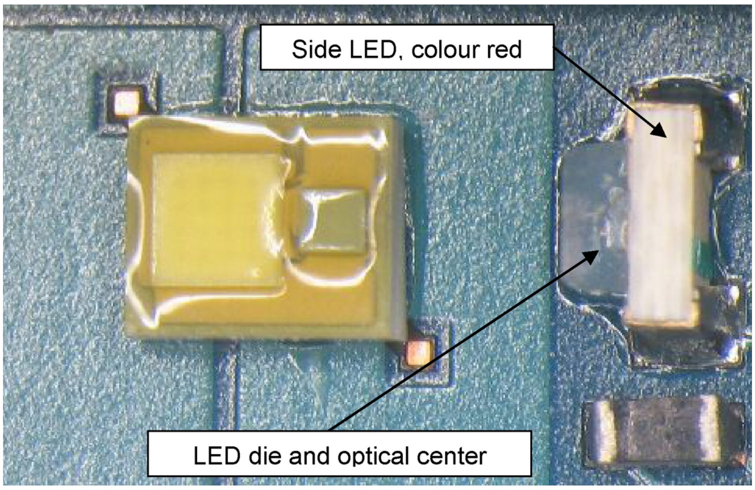
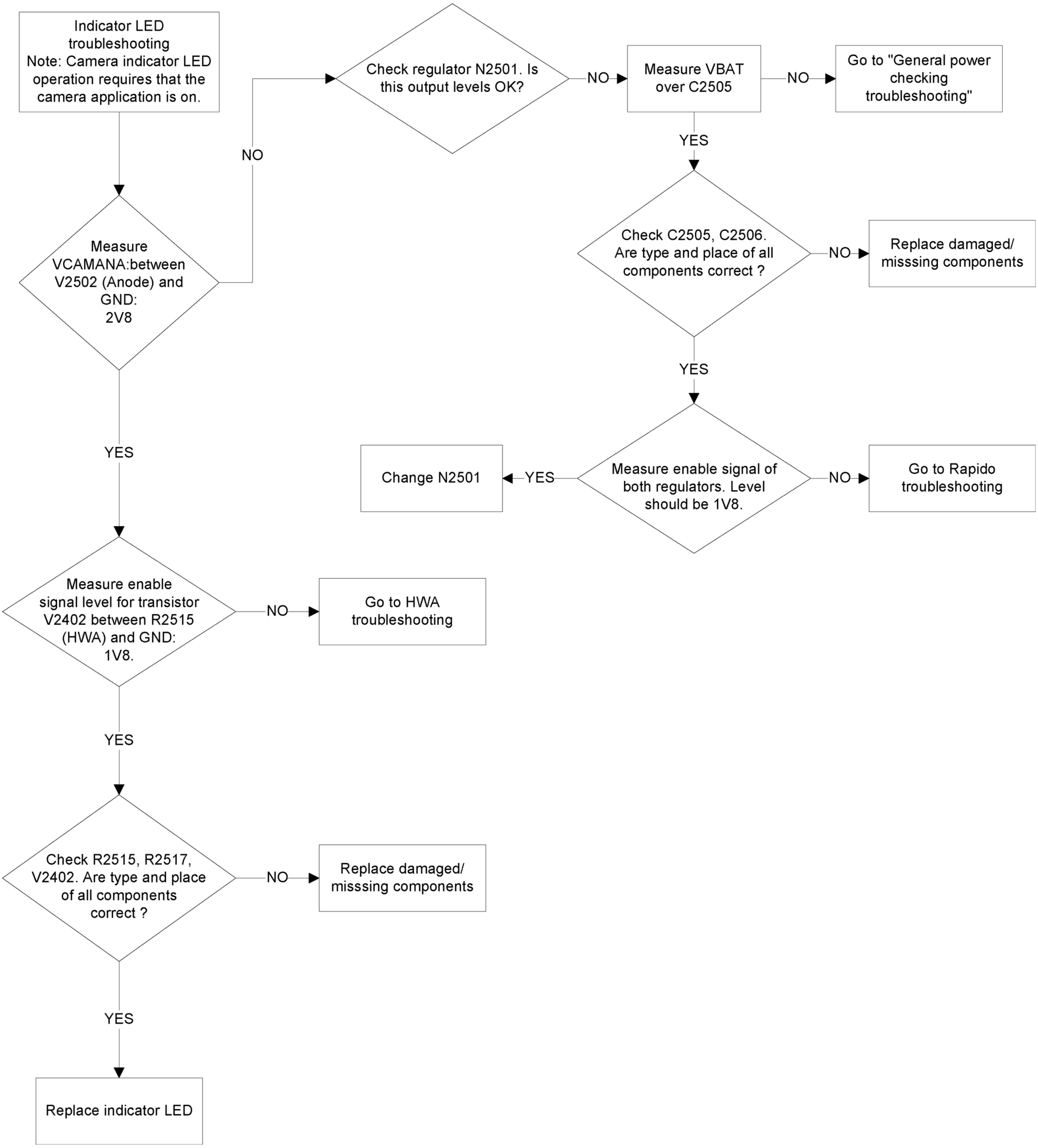

Side LED, colour red
LED die and optical center

Figure 91 Mechanical construction of the indicator LED

Camera indicator LED troubleshooting

Troubleshooting flow


Indicator LED troubleshooting
Note: Camera indicator LED operation requires that the camera application is on.
Check regulator N2501. Is this output levels OK?
NO
Measure VBAT over C2505
NO
Go to "General power checking troubleshooting"
NO
YES
Measure VCAMANA:between V2502 (Anode) and GND: 2V8
Check C2505, C2506. Are type and place of all components correct ?
NO
Replace damaged/ misssing components
YES
YES
Change N2501
YES
Measure enable signal of both regulators. Level should be 1V8.
NO
Go to Rapido troubleshooting
Measure enable signal level for transistor V2402 between R2515 (HWA) and GND: 1V8.
NO
Go to HWA troubleshooting
YES
Check R2515, R2517, V2402. Are type and place of all components correct ?
NO
Replace damaged/ misssing components
YES
Replace indicator LED

7 — System Module and User Interface

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Table of Contents

Introduction 7–7
    Phone description 7–7
Energy management 7–10
    Battery and charging 7–10
    Backup battery 7–11
    Normal and extreme voltages 7–11
    Power key and system power-up 7–12
    Modes of operation 7–12
    Power distribution 7–13
    Clocking scheme 7–13
Bluetooth 7–14
FM radio 7–15
USB 7–16
CBUS interface 7–16
FBUS 7–16
ECI interface 7–16
Charger interface 7–16
SIM interface 7–16
µSD card interface 7–17
Camera concept 7–18
    Cameras 7–18
    Main camera characteristics 7–18
    Secondary camera characteristics 7–19
    Camera flash 7–20
    Hardware accelerator 7–21
User interface 7–22
    Display module 7–22
    [[[ERROR: No title available for <master_section>]]] 7–
        Main display characteristics 7–23
        Cover UI display characteristics 7–24
    Keyboard and other keys 7–25
    Backlight and illumination 7–27
        Display and cover UI key illumination 7–27
        Keyboard illumination 7–27
        Power LED 7–28
    MR sensor 7–29
ASICs 7–30
    RAPIDO ASIC 7–30
    EM ASIC N2300 7–30
    EM ASIC N2200 7–30
Device memories 7–30
    RAPIDO memories NOR flash and SDRAM 7–30
    Combo memory 7–30
Audio concept 7–31
    Audio HW architecture 7–31
    Internal microphone 7–31
    External microphone 7–32
    Internal earpiece 7–32
    Internal speaker 7–33
    External earpiece 7–34

Vibra circuitry 7–34
AV connector 7–35
Baseband technical specifications 7–35
External interfaces 7–35
SIM IF connections 7–36
Charger connector and charging interface connections & electrical characteristics 7–36
Internal interfaces 7–37
Back-up battery interface electrical characteristics 7–37
RF description 7–38
Block diagram 7–38
Receiver (RX) 7–38
Transmitter (TX) 7–39
Frequency mappings 7–40
GSM850 frequencies 7–40
EGSM900 frequencies 7–40
GSM1800 frequencies 7–41
GSM1900 frequencies 7–43
WCDMA 2100 Rx frequencies 7–44
WCDMA 2100 Tx frequencies 7–45

List of Tables

Table 8 Nominal voltages 7–11
Table 9 UI and side keys 7–26
Table 10 Cover UI keys 7–27
Table 11 AV interface electrical characteristics 7–35
Table 12 Charging interface connections 7–36
Table 13 Charging IF electrical characteristics 7–36
Table 14 Back-up battery connections 7–37
Table 15 Back-up battery electrical characteristics 7–37

List of Figures

Figure 92 Battery pin order 7–10
Figure 93 Blade battery connector 7–10
Figure 94 Small (left) and wide (right) charger plugs 7–11
Figure 95 Clocking scheme 7–14
Figure 96 Bluetooth interface 7–15
Figure 97 SIM interface 7–17
Figure 98 SD interface 7–17
Figure 99 Main camera image orientation 7–19
Figure 100 Secondary camera mechanical outline 7–20
Figure 101 Flash and indicator LEDs 7–20
Figure 102 Camera overview 7–22
Figure 103 Display overview 7–23
Figure 104 Main display mechanical outline 7–24
Figure 105 Cover UI display mechanical outline 7–25
Figure 106 Cover user interface keys 7–25
Figure 107 Keyboard layout 7–26
Figure 108 Illumination overview 7–27
Figure 109 High voltage regulator circuit 7–28
Figure 110 Power LED high side driver 7–29

Figure 111 MR sensor connection 7–29
Figure 112 Audio block diagram 7–31
Figure 113 Internal microphone circuitry 7–32
Figure 114 External earpiece and microphone circuitry 7–32
Figure 115 Internal earpiece circuitry (engine side) 7–33
Figure 116 Internal earpiece circuitry (lid side) 7–33
Figure 117 Internal speaker circuitry 7–34
Figure 118 External earpiece and microphone circuitry 7–34
Figure 119 Vibra circuitry 7–35
Figure 120 Charger connector 7–36
Figure 121 RF block diagram using RF ASIC N7505 7–38

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Introduction

Phone description

RAPIDO is the main digital baseband ASIC in the phone. It contains functionality for both WCDMA and GSM EDGE.

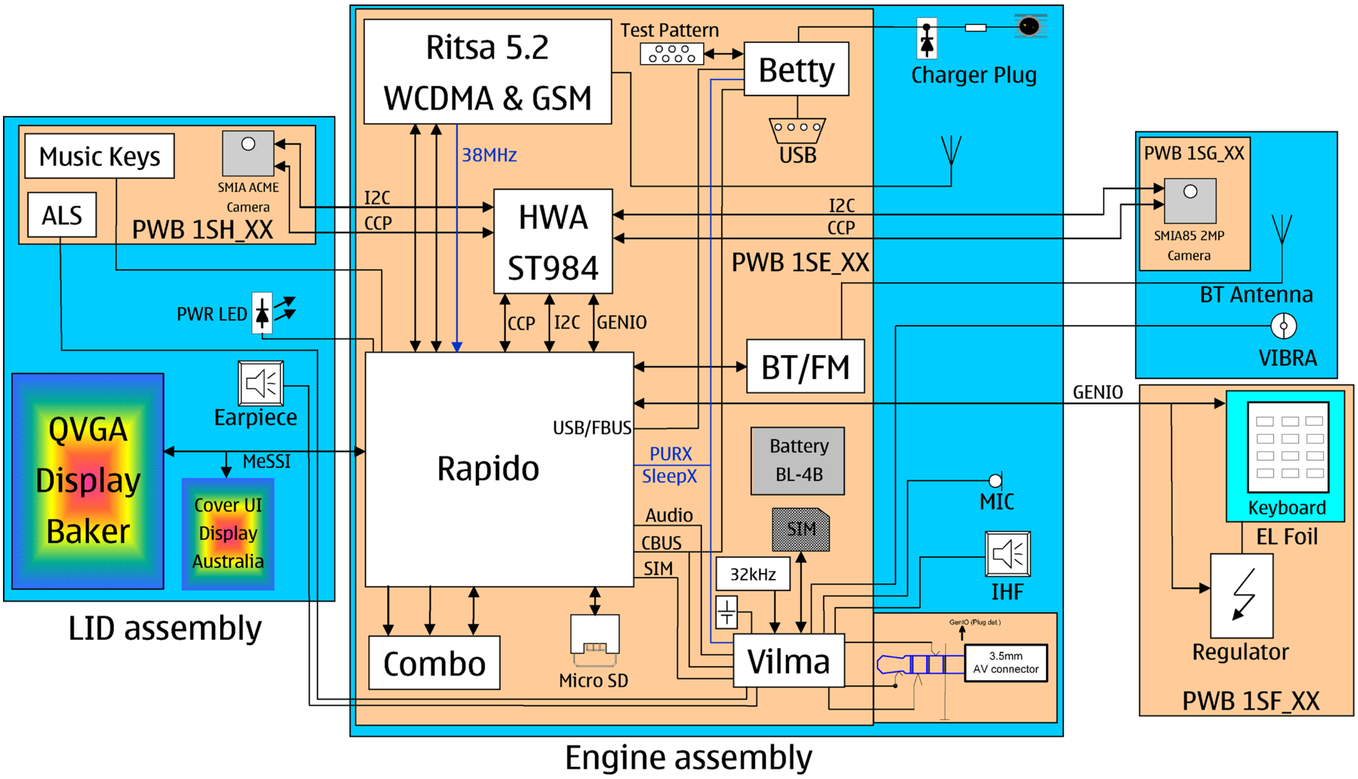
AVILMA is mainly the audio ASIC in the phone and BETTY is basically the energy management controller for the phone.

Bluetooth and FM radio are physically integrated in one single ASIC.

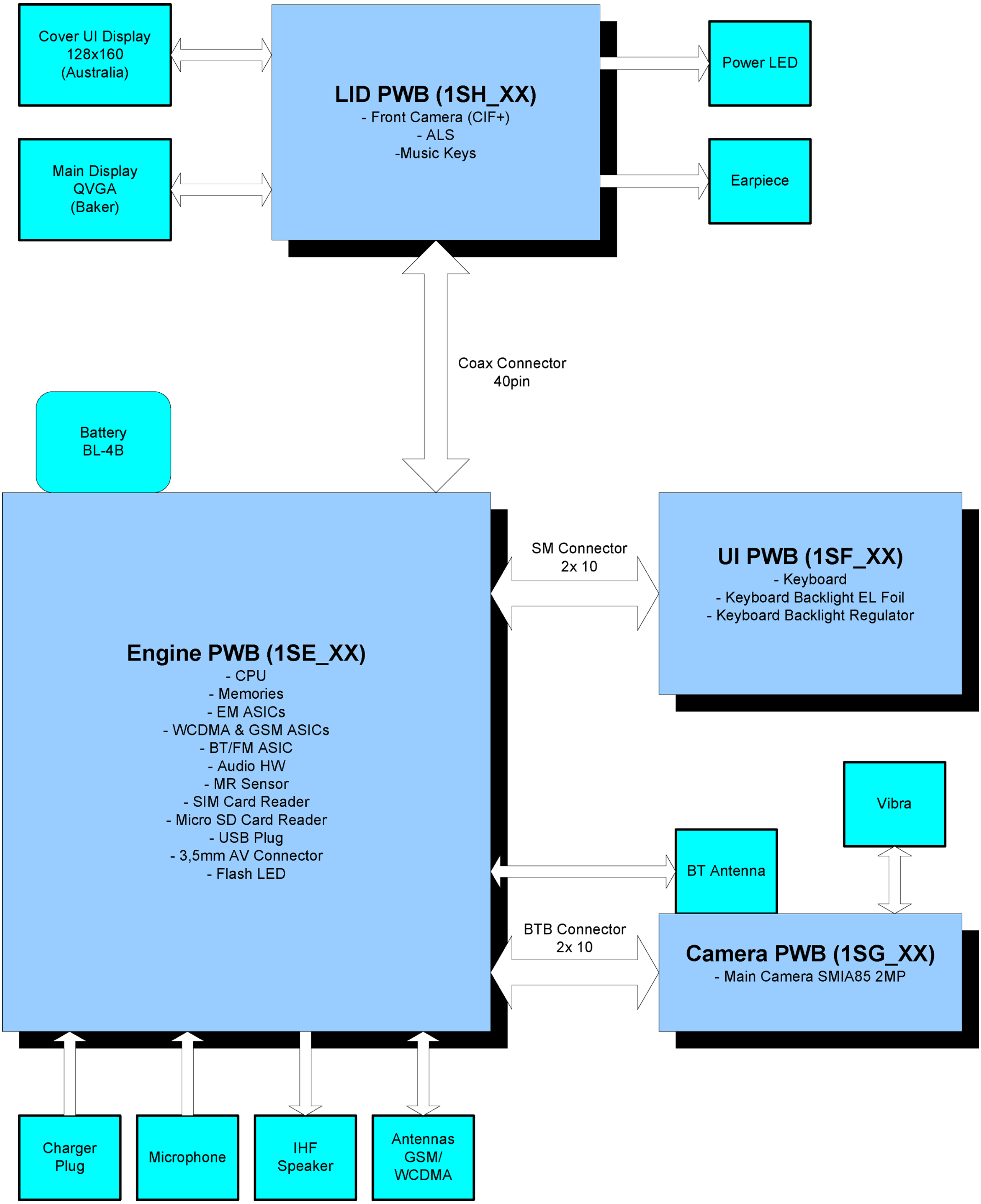
Key components

Function	Description	Item ref
Baseband ASIC	AVILMA BETTY	N2200 N2300
RF ASIC	Ahneus	N7505
Processor	RAPIDO	D2800
Camera acceledator	HWA STV984N	D2500
PA GSM	Front end module (FEM), quad band	N7520
PA WCDMA		N7540
Oscillators	VCTCXO Balun GSM Balum WCDMA	G7501 T7502 T7580
Memory	768Mb DDR SDRAM + 1Gb NAND FLASH Combo	D3000
Back-up battery	RTC back-up battery 311	G2200
FM radio	BTHFM1.0 module	D6000
Bluetooth	BTHFM1.0 module	D6000
MR sensor	MR 10 magnetoresistive sensor	N2401
Battery	BL-4B	
Battery connector	Tabby blade interface	X2070
RF connector		X7501

System module block diagram


Ritsa 5.2
WCDMA & GSM
Test Pattern
Betty
Charger Plug
USB
38MHz
I2C
CCP
HWA
ST984
I2C
CCP
PWB 1SE_XX
CCP
I2C
GENIO
Music Keys
SMIA ACME Camera
ALS
PWB 1SH_XX
PWR LED
Earpiece
QVGA Display Baker
MeSSI
Cover UI Display Australia
LID assembly
Rapido
USB/FBUS
PURX
SleepX
Audio
CBUS
SIM
BT/FM
Battery BL-4B
SIM
32kHz
Combo
Micro SD
Vilma
MIC
IHF
GenIO (Plug det.)
3.5mm AV connector
Engine assembly
PWB 1SG_XX
SMIA85 2MP Camera
BT Antenna
VIBRA
GENIO
Keyboard
EL Foil
Regulator
PWB 1SF_XX

Board and module connections


Cover UI Display
128x160
(Australia)
Main Display
QVGA
(Baker)
LID PWB (1SH_XX)
- Front Camera (CIF+)
- ALS
-Music Keys
Power LED
Earpiece
Coax Connector
40pin
Battery
BL-4B
Engine PWB (1SE_XX)
- CPU
- Memories
- EM ASICs
- WCDMA & GSM ASICs
- BT/FM ASIC
- Audio HW
- MR Sensor
- SIM Card Reader
- Micro SD Card Reader
- USB Plug
- 3,5mm AV Connector
- Flash LED
SM Connector
2x 10
UI PWB (1SF_XX)
- Keyboard
- Keyboard Backlight EL Foil
- Keyboard Backlight Regulator
Vibra
BT Antenna
BTB Connector
2x 10
Camera PWB (1SG_XX)
- Main Camera SMIA85 2MP
Charger
Plug
Microphone
IHF
Speaker
Antennas
GSM/
WCDMA

Energy management

Battery and charging

BL-4B battery

The phone is powered by a BL-4B battery block. It provides a capacity of 700 mAh minimum and contains a BSI resistor for the battery identification. Its battery interface is based on blade type connector where the transceiver side has blades and the counter parts are on battery side.

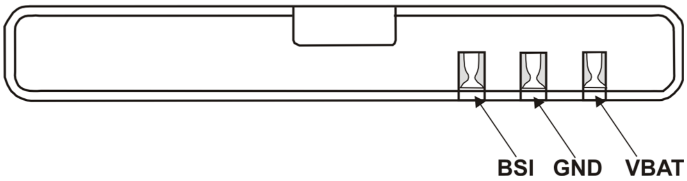


Figure 92 Battery pin order

The battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line. This is located on the main PWB, at the place where the phone temperature is closest to the battery temperature.

Battery connector

The battery connector is a blade connector. It has three blades;

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

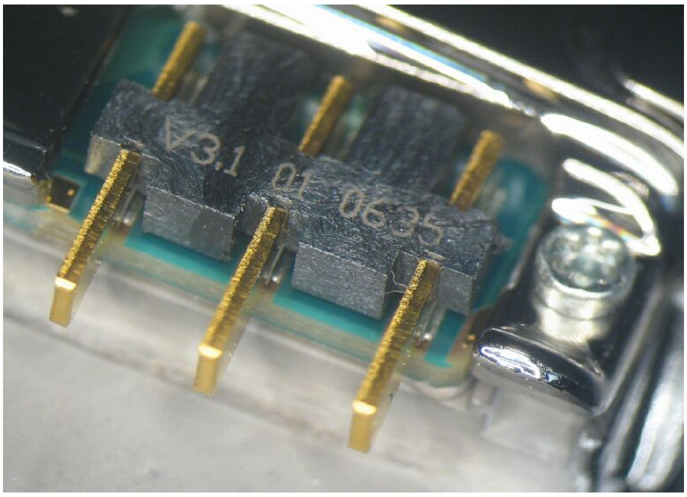


Figure 93 Blade battery connector

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The wider standard charger (3.5 mm) can be used together with the CA-44 charger adapter.

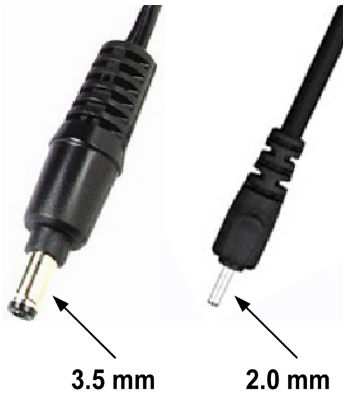


Figure 94 Small (left) and wide (right) charger plugs

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Backup battery

When the main battery is not attached EM ASIC (N2200) goes in backup mode using back-up battery that supplies voltage to RTC in EM ASIC (N2200).

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) BETTY and AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below, normal and extreme voltages are shown when a BL-4B battery is used.

Table 8 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	
Higher extreme voltage	4.230	
(fast charging)		
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.25	In call
Sw shutdown	3.25	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

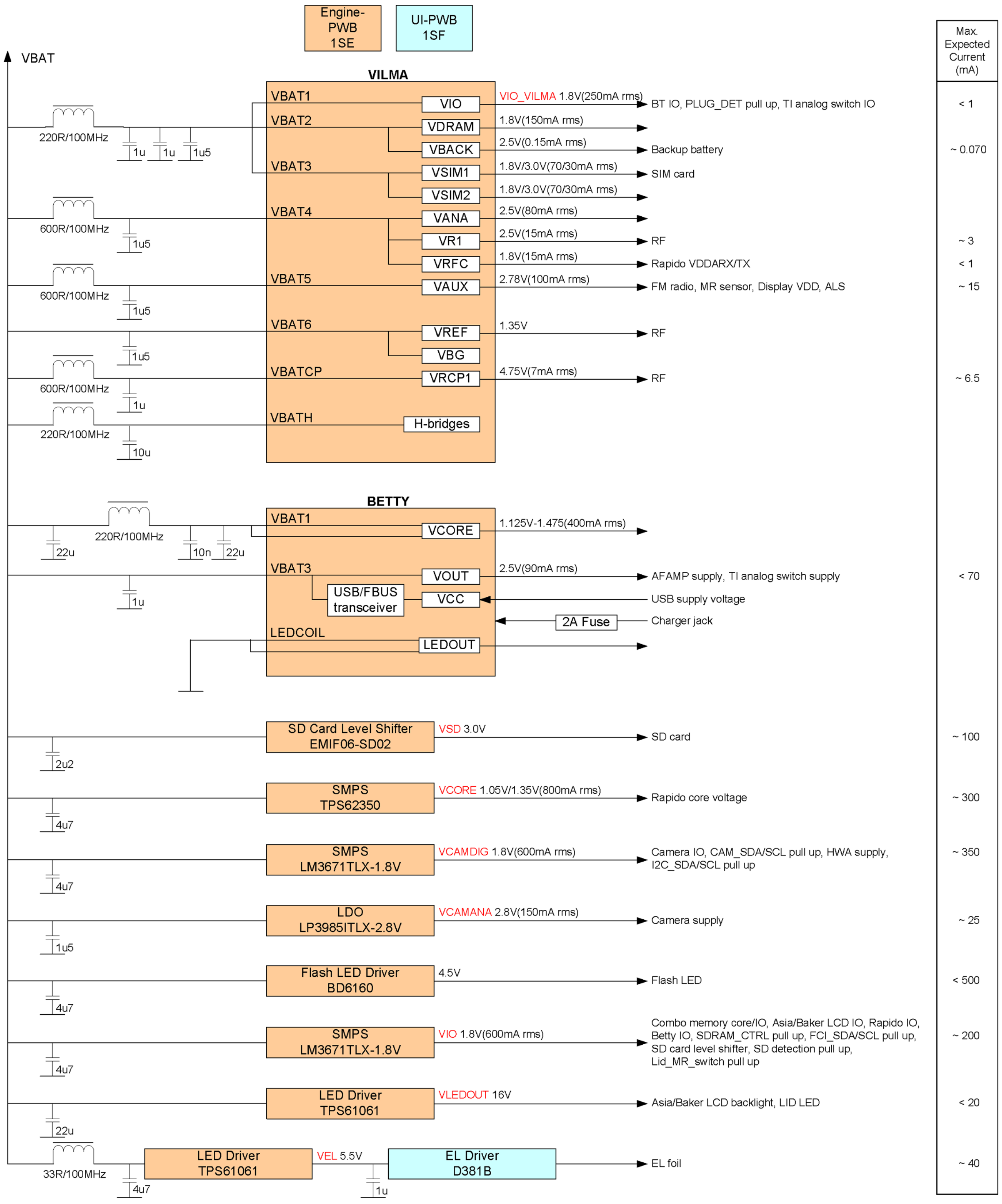
When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2300 BETTY master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Power distribution


Engine-PWB 1SE
UI-PWB 1SF
VBAT
Max. Expected Current (mA)
VILMA
VBAT1
VBAT2
VBAT3
VBAT4
VBAT5
VBAT6
VBATCP
VBATH
VIO
VDRAM
VBACK
VSIM1
VSIM2
VANA
VR1
VRFC
VAUX
VREF
VBG
VRCP1
H-bridges
220R/100MHz
1u
1u
1u5
600R/100MHz
1u5
600R/100MHz
1u5
1u5
600R/100MHz
1u
220R/100MHz
10u
VIO_VILMA 1.8V(250mA rms)
BT IO, PLUG_DET pull up, TI analog switch IO
< 1
1.8V(150mA rms)
2.5V(0.15mA rms)
Backup battery
~ 0.070
1.8V/3.0V(70/30mA rms)
SIM card
1.8V/3.0V(70/30mA rms)
2.5V(80mA rms)
2.5V(15mA rms)
RF
~ 3
1.8V(15mA rms)
Rapido VDDARX/TX
< 1
2.78V(100mA rms)
FM radio, MR sensor, Display VDD, ALS
~ 15
1.35V
RF
4.75V(7mA rms)
RF
~ 6.5
BETTY
VBAT1
VCORE
220R/100MHz
22u
10n
22u
1.125V-1.475(400mA rms)
VBAT3
VOUT
2.5V(90mA rms)
AFAMP supply, TI analog switch supply
< 70
USB/FBUS transceiver
VCC
USB supply voltage
1u
2A Fuse
Charger jack
LEDCOIL
LEDOUT
SD Card Level Shifter EMIF06-SD02
VSD 3.0V
SD card
~ 100
2u2
SMPS TPS62350
VCORE 1.05V/1.35V(800mA rms)
Rapido core voltage
~ 300
4u7
SMPS LM3671TLX-1.8V
VCAMDIG 1.8V(600mA rms)
Camera IO, CAM_SDA/SCL pull up, HWA supply, I2C_SDA/SCL pull up
~ 350
4u7
LDO LP3985ITLX-2.8V
VCAMANA 2.8V(150mA rms)
Camera supply
~ 25
1u5
Flash LED Driver BD6160
4.5V
Flash LED
< 500
4u7
SMPS LM3671TLX-1.8V
VIO 1.8V(600mA rms)
Combo memory core/IO, Asia/Baker LCD IO, Rapido IO, Betty IO, SDRAM_CTRL pull up, FCI_SDA/SCL pull up, SD card level shifter, SD detection pull up, Lid_MR_switch pull up
~ 200
4u7
LED Driver TPS61061
VLEDOUT 16V
Asia/Baker LCD backlight, LID LED
< 20
22u
33R/100MHz
4u7
LED Driver TPS61061
VEL 5.5V
1u
EL Driver D381B
EL foil
~ 40

Clocking scheme

In BB5, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by AVILMA with an external crystal.

32 k Sleep Clock is always powered on after startup. Sleep clock is used by RAPIDO for low-power operation.

SMPS Clk is 2.4 MHz clock line from RAPIDO to BETTY. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4 MHz signal from AHNEUS ASIC to BT module.

CLK600. The clock source is internal RC oscillator in BETTY (during the power-up sequence) or RAPIDO SMPS Clk.

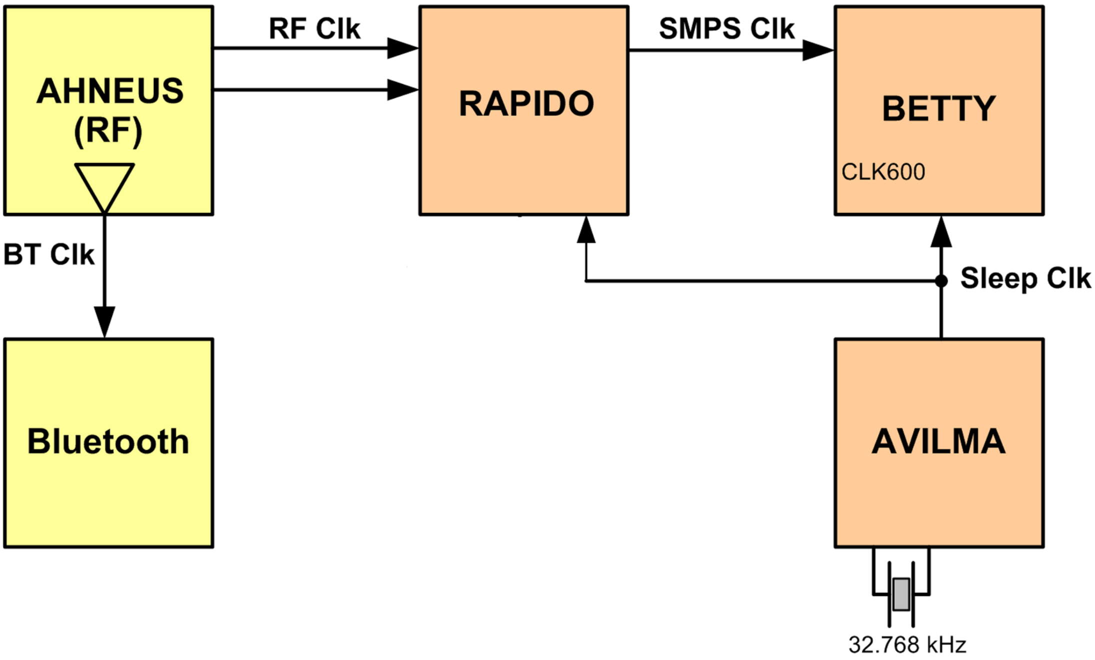


Figure 95 Clocking scheme

Bluetooth

Bluetooth provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Data and control interface for a low power RF module is provided by the module.

The Bluetooth is physically integrated with the FM radio into one single module. From a functional point of view they, however, have nothing in common.

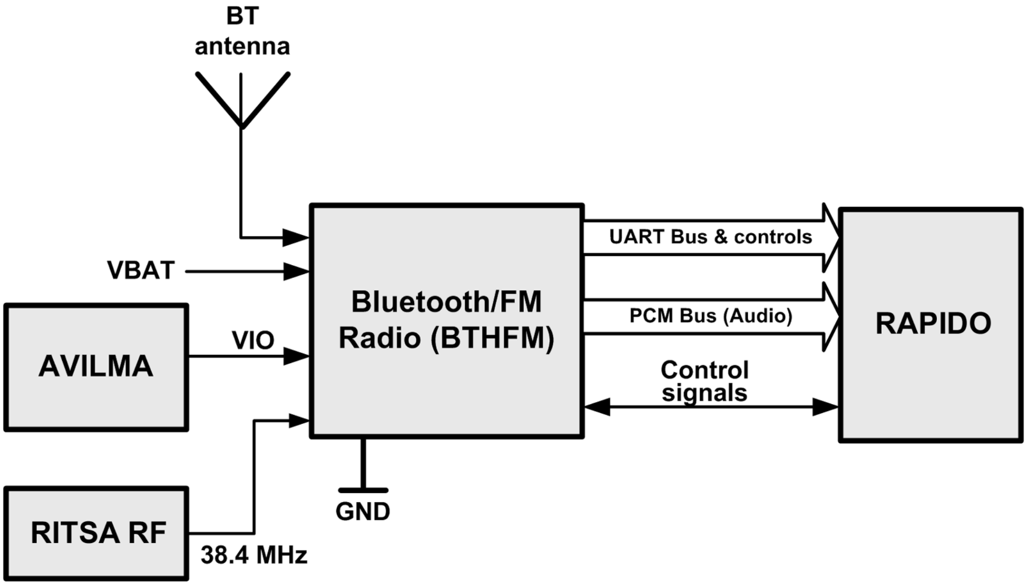
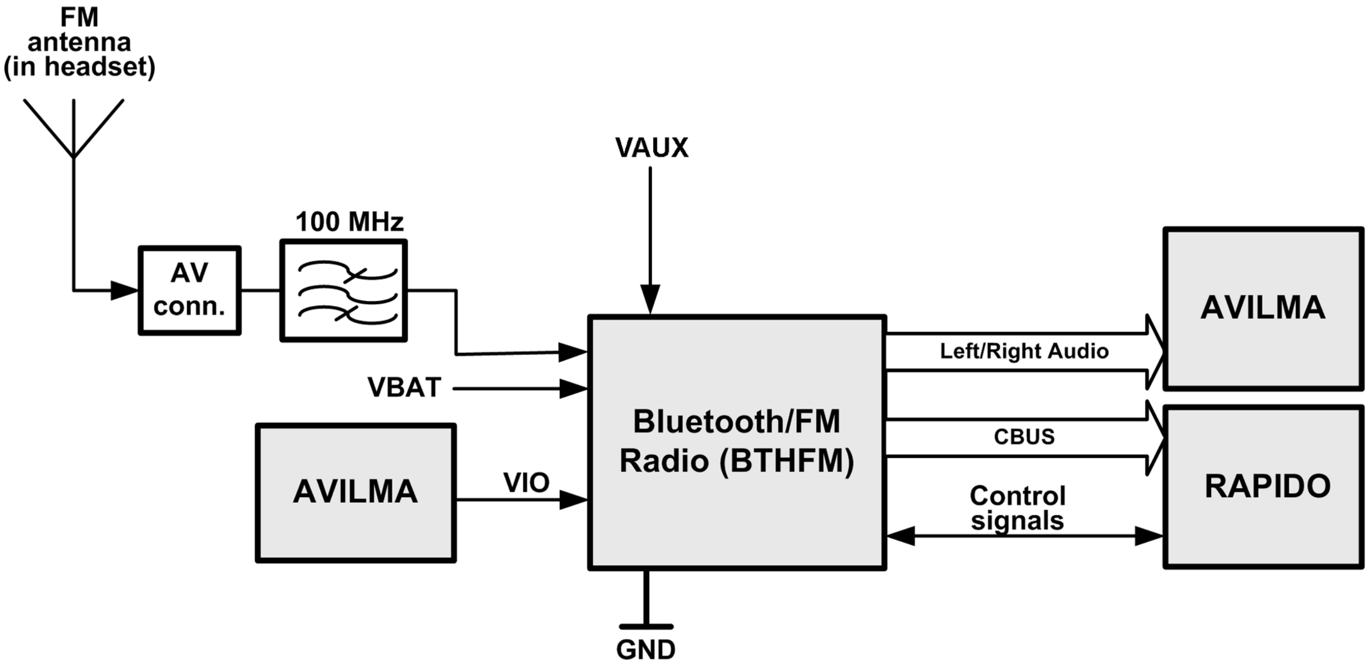

BT antenna
VBAT
AVILMA
VIO
RITSA RF
38.4 MHz
Bluetooth/FM Radio (BTHFM)
GND
UART Bus & controls
PCM Bus (Audio)
Control signals
RAPIDO

Figure 96 Bluetooth interface

The Bluetooth has a separate built in antenna and is powered by VBAT and the regulated voltage VIO. For audio applications the Bluetooth has a PCM data bus. In addition a UART (universal asynchronous receiver/transmitter) is used for data communication and controls.

FM radio

The FM radio is physically integrated with the Bluetooth into one single module. From a functional point of view they, however, have nothing in common.


FM antenna (in headset)
AV conn.
100 MHz
VAUX
VBAT
AVILMA
VIO
Bluetooth/FM Radio (BTHFM)
GND
Left/Right Audio
CBUS
Control signals
AVILMA
RAPIDO

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as elements of the antenna, and no other antenna is needed for FM radio reception.

The FM radio is provided with VAUX (2V8).

The radio has an automatic band search function, which can search for a strong station.

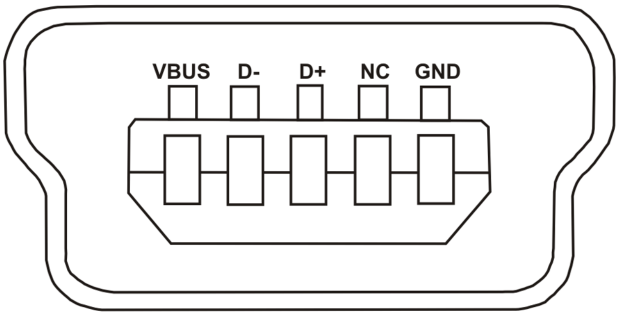
USB

USB (Universal Serial Bus) provides a wired connectivity between a PC and peripheral devices. It is a differential serial bus.

USB 2.0 is supported with full speed (12 Mbps).

Hot swap is supported, which means that USB devices may be plugged in/out at any time.

This phone is provided with a specific connector for mini USB.



CBUS interface

CBUS is a "main" system control bus in BB5. RAPIDO controls the functionality of EM ASIC (N2200) and EM ASIC (N2300) ASICs with CBUS.

CBUS is a four-wire half-duplex master-slave interface. In BB5 CBUS clock frequency is 2.4 MHz.

FBUS

USB and FBUS have multiplexed interface between EM ASIC (2300) and RAPIDO.

ECI interface

The ECI (Enhancement Control Interface) is a point-to-point, bi-directional, single line serial bus.

The purpose of the ECI is to identify and authenticate the accessory, and to act as a data bus (intended for control purposes) between the phone and the accessory .

Charger interface

Charging control and charge switch are situated in EM ASIC (N2300).

If the temperature rises too high and the thermal protection is activated, EM ASIC (N2300) goes to protection mode.

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAPIDO and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

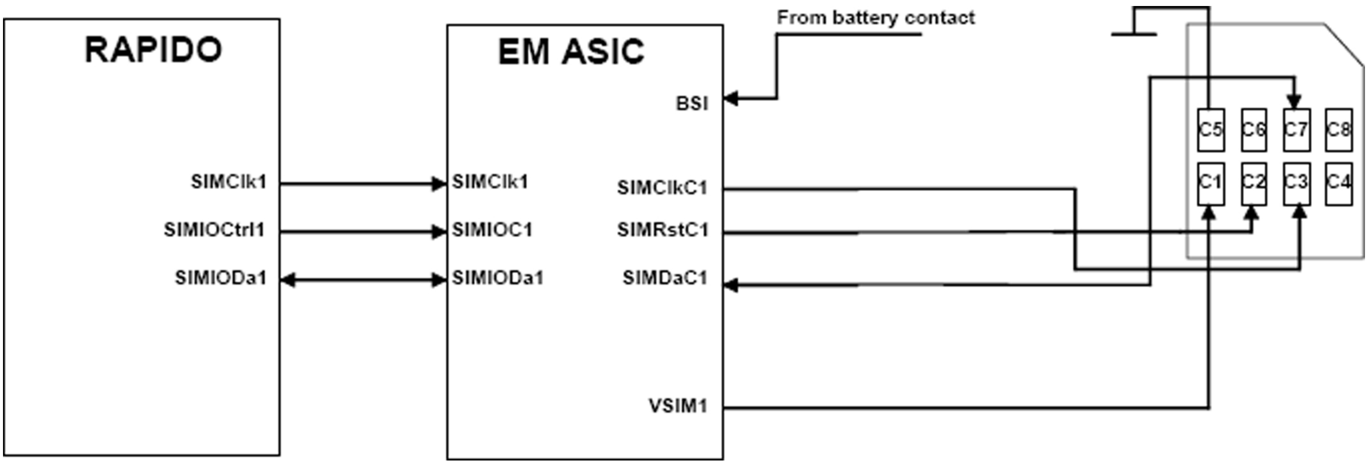

RAPIDO
SIMClk1
SIMIOCtrl1
SIMIODa1
EM ASIC
BSI
SIMClk1
SIMIOC1
SIMIODa1
SIMClkC1
SIMRstC1
SIMDaC1
VSIM1
From battery contact
C5
C6
C7
C8
C1
C2
C3
C4

Figure 97 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM IF.

The EM ASIC SIM1 interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used. The data communication between the card and the phone is asynchronous half duplex, and the clock supplied to the card is 1-5 MHz, which is 3.2 MHz by default (in GSM system). The data baud rate is the SIM card clock frequency divided by 372 (by default), 64, 32 or 16.

µSD card interface

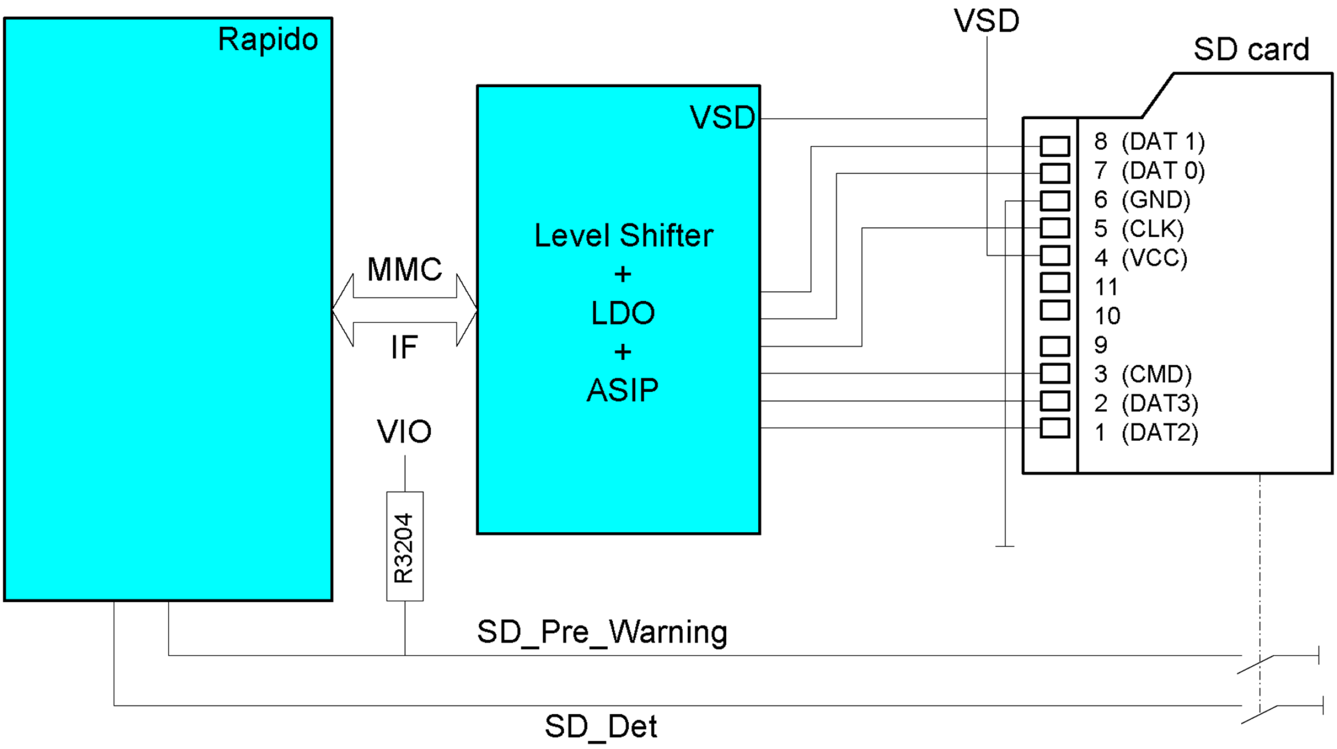

Rapido
MMC
IF
VIO
R3204
VSD
Level Shifter
+
LDO
+
ASIP
VSD
SD card
8 (DAT 1)
7 (DAT 0)
6 (GND)
5 (CLK)
4 (VCC)
11
10
9
3 (CMD)
2 (DAT3)
1 (DAT2)
SD_Pre_Warning
SD_Det

Figure 98 SD interface

The µSD card is connected to the engine by an external level shifter with an ESD protection filter. Supplied voltages:

- VSD: 2.85 V (from level shifter)
- VIO: 1.8 V (from AVILMA)

The µSD card door state is detected by a detect switch. When the door is open, the uSD card is powered off. Hot swap is supported, which means that the card may be plugged in/out at any time, without removing the battery.

Camera concept

Cameras

The device has two integrated digital cameras. The main camera is meant for high quality still imaging and video capture. The secondary (front) camera is meant for video conferencing but it can also be used for still image capture.

Main camera characteristics

Sensor type	CMOS
Sensor photo detectors	2.0 Million (1600 x 1200 pixels)
F number/Aperture	f/2.8
Focal length	4.4 mm
Focus range	40 cm to infinity
Still Image resolutions	1600x1200, 1152x864 and 640x480
Still images file format	EXIF (JPEG), *.jpg
Video resolutions	320x240, 176x144 and 128x96
Video clip length	30 sec short mode or 1 hour free mode
Video file format	3GPP, (*.3gp)
Exposure control	Automatic
White balance	Automatic, sunny, cloudy, incandescent, flurescent
Colour tones	Normal, sepia, vivid, black&white, negative
Capture Modes	Still capture mode, video mode and sequence mode
Selftimer	10, 20, 30 s
Flash settings	Auto, off and forced

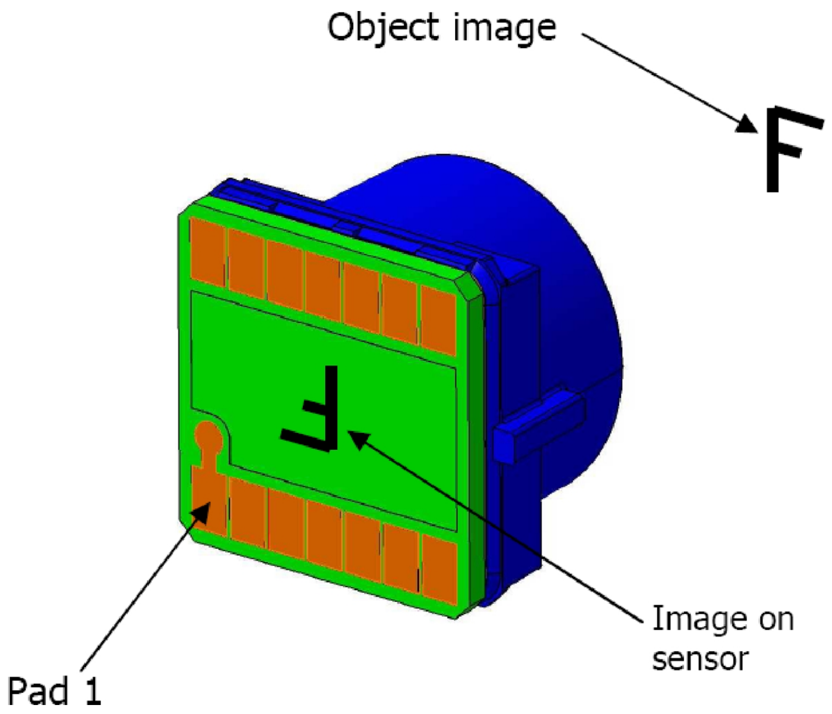


Figure 99 Main camera image orientation

Secondary camera characteristics

Sensor type	CMOS
Sensor photo detectors (effective)	384x320
F number/Aperture	2.8
Focus range	25cm -> 1m
Still image resolutions	320x240
Still images format	EXIF (.jpg)
Video resolutions	352x288, 176x144 or 128x96
Video clip length	30sec short mode or 1 hour free mode
Video file format	3GPP, (*.3gp)
White Balance	Automatic
Colours	16.7 Million, 24bit

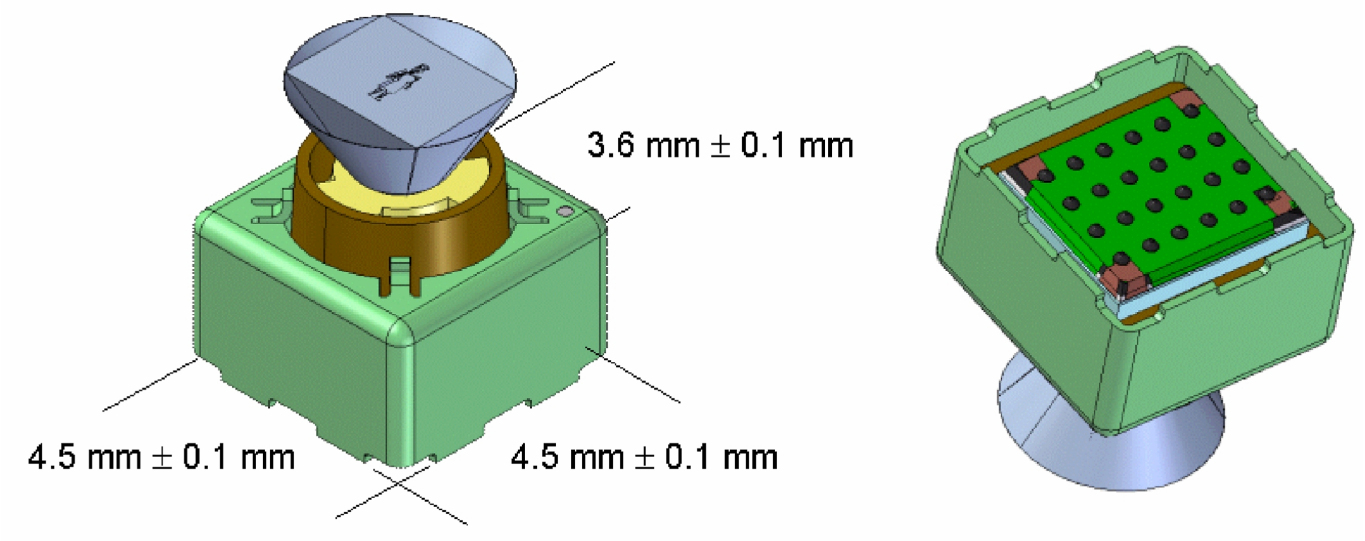


Figure 100 Secondary camera mechanical outline

Camera flash

The device back camera has a camera flash module located directly beside the camera, providing better lighting conditions in darker environments. The indicator LED close to the flash module is used as an indicator light for certain use cases.

The camera flash is a single die, ultra compact light sources. Therefore the LED does not include lens. It is part of the phone cover to ensure a proper light pattern at the target.

The dimensions of the camera flash module are 1.65 ± 0.1 mm x 2.05 ± 0.1 mm x 0.7 mm.

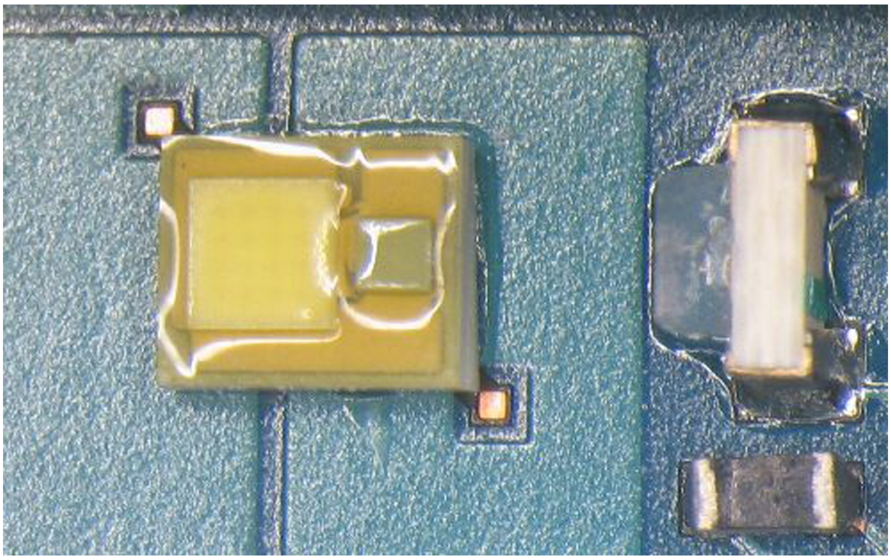
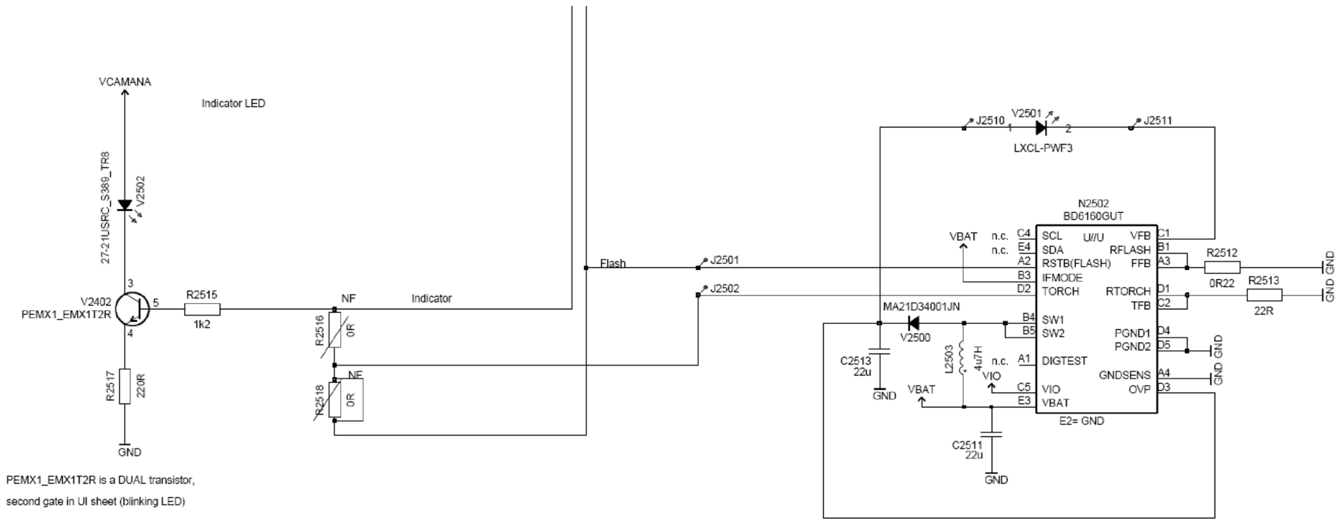


Figure 101 Flash and indicator LEDs


VCAMANA
Indicator LED
27-21USRC_S389_TR8
V2502
3
5
4
V2402
PEMX1_EMX1T2R
R2515
1k2
R2517
220R
GND
NF
Indicator
R2516
0R
NF
R2518
0R
Flash
J2501
J2502
J2510
V2501
1
2
J2511
LXCL-PWF3
N2502
BD6160GUT
VBAT
n.c.
n.c.
C4
E4
A2
B3
D2
SCL
SDA
RSTB(FLASH)
IFMODE
TORCH
U//U
VFB
RFLASH
FFB
RTORCH
TFB
C1
B1
A3
D1
C2
R2512
0R22
R2513
22R
GND
GND
MA21D34001JN
V2500
B4
B5
SW1
SW2
PGND1
PGND2
D4
D5
GND
C2513
22u
GND
L2503
4u7H
n.c.
A1
DIGTEST
GNDSENS
A4
GND
VIO
VBAT
C5
E3
VIO
VBAT
OVP
D3
E2= GND
C2511
22u
GND

PEMX1_EMX1T2R is a DUAL transistor,
second gate in UI sheet (blinking LED)

L : DC_MAX=140mR, I_RC=1A

Hardware accelerator

The STV0984N is an ultra low power mobile imaging digital signal processor which supports SMIA CMOS color image sensors up to 2 Megapixel resolution. It performs all the required data processing to deliver good quality in view finder, still and movie color images.

The STV0984N performs high quality color processing on images, achieving JPEG compression if requested by Rapido. Further, it includes programmable GPIOs to control external flash LED. STV0984 provides internal buffering capability along with a versatile clock manager to accommodate different data rates between input sensors and Rapido interface.

Data is transferred from sensor to STV0984N through Low Electromagnetic Interference (EMI) interface; using the CCP 2.0 data transfer protocol over LVDS (2 separate CCP 2.0 receivers).

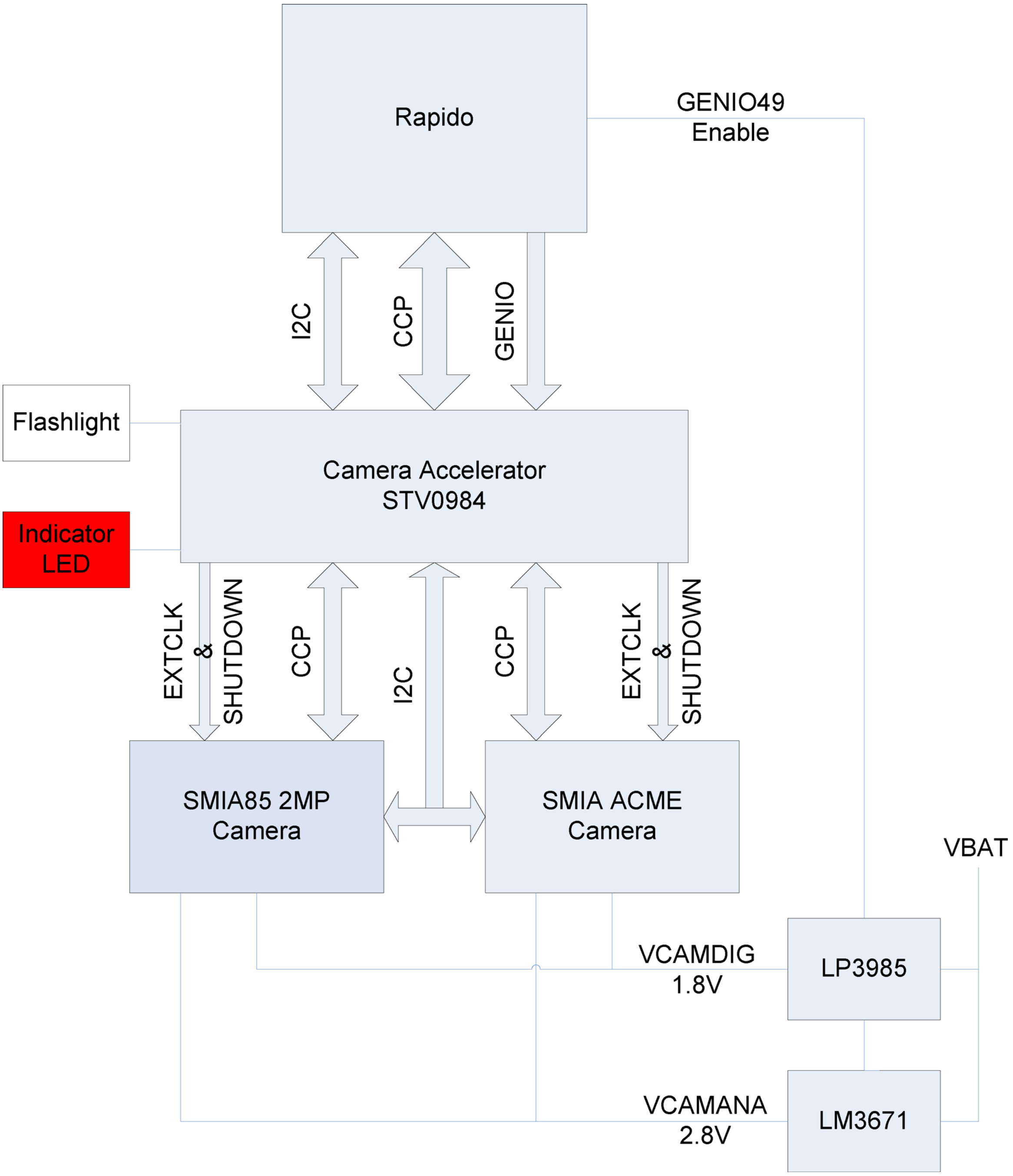

Rapido
GENIO49
Enable
I2C
CCP
GENIO
Flashlight
Camera Accelerator
STV0984
Indicator
LED
EXTCLK
&
SHUTDOWN
CCP
I2C
CCP
EXTCLK
&
SHUTDOWN
SMIA85 2MP
Camera
SMIA ACME
Camera
VBAT
VCAMDIG
1.8V
LP3985
VCAMANA
2.8V
LM3671

Figure 102 Camera overview

User interface

Display module

This phone has two displays:

- Main display: Active TFT QVGA display supports up to 16,777,216 colors (320 x 240 pixels, 2.2 inches)
- Cover UI display: Active TFT display supports up to 262,144 colors (128 x 160 pixels, 1.36 inches)

Both displays are connected to Rapido MeSSI interface. That means they are using the same multiplexed MeSSI interface and it has dedicated CSX and TE signals. Signal filtering is done via LCD-ASIP components placed on engine PWB. The MeSSI interface is operated with 9.6 MHz.

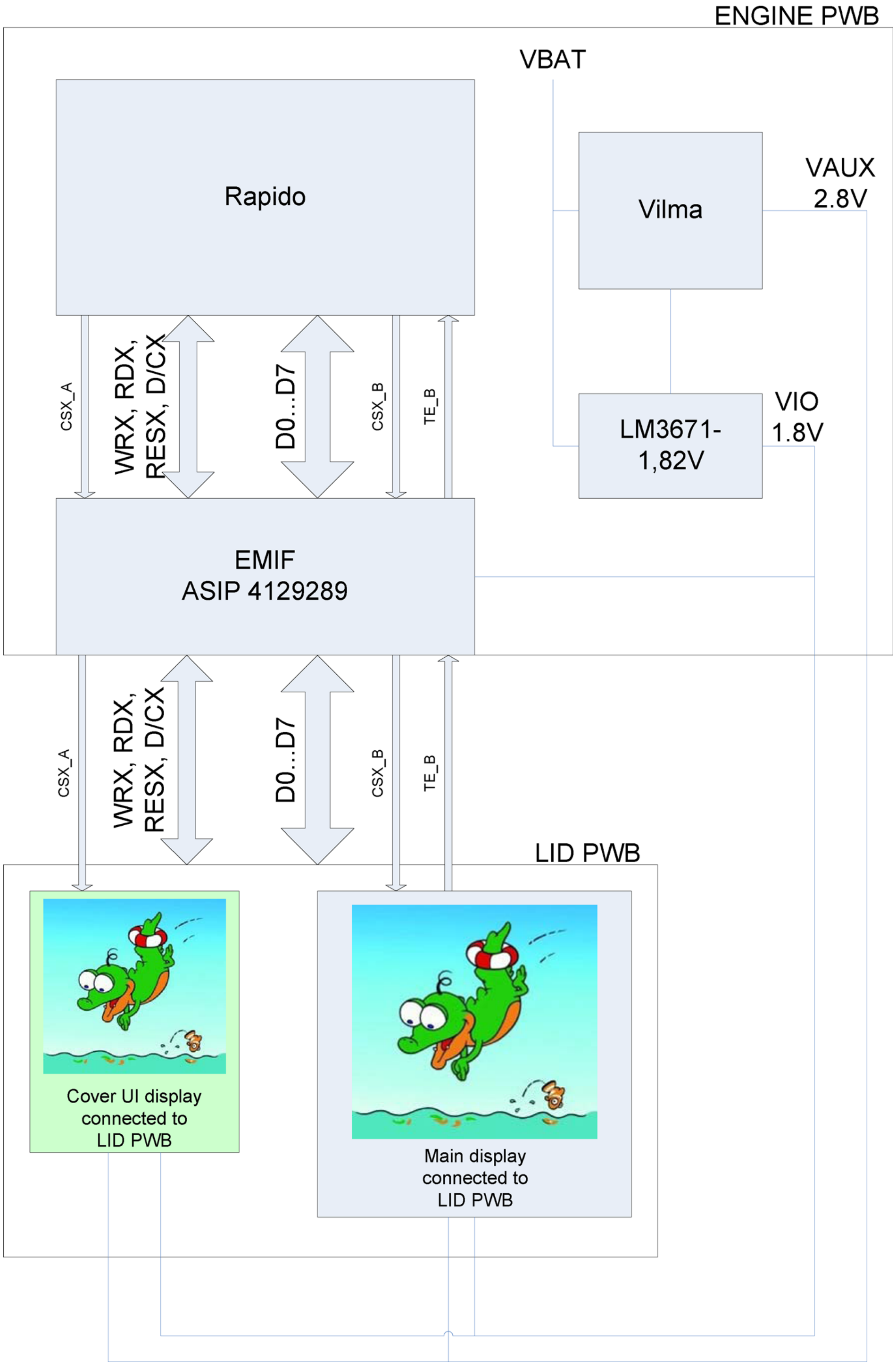

ENGINE PWB
VBAT
Rapido
Vilma
VAUX
2.8V
LM3671-
1,82V
VIO
1.8V
CSX_A
WRX, RDX,
RESX, D/CX
D0...D7
CSX_B
TE_B
EMIF
ASIP 4129289
CSX_A
WRX, RDX,
RESX, D/CX
D0...D7
CSX_B
TE_B
LID PWB
Cover UI display
connected to
LID PWB
Main display
connected to
LID PWB

Figure 103 Display overview

Main display characteristics

Item	Specification
Active Area Resolution	240x320 (166ppi)
Interface	MeSSI-8/16 with 8 bit data IF
Number of Colors	24bit (normal mode)
	3bit (partial mode)

Item	Specification
Size	41,8mm x 59,4mm x 2mm
Illumination	2x2 white LEDs
	230 mcd
Viewing Angle	3,6,9,12 o'clock
Technology	AM-LCD

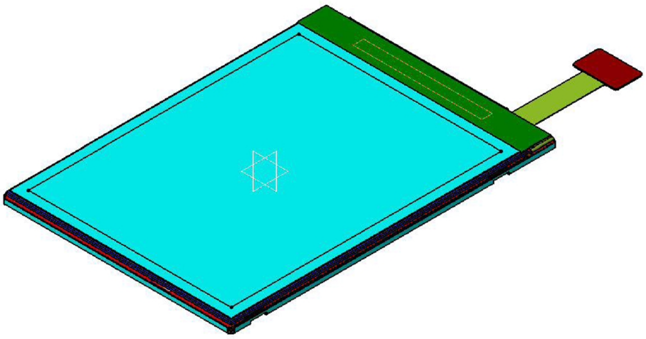


Figure 104 Main display mechanical outline

Cover UI display characteristics

Item	Specification
Active Area Resolution	160x128 (dot pitch 0,168 x 0,168mm)
Interface	MeSSI-8/16 with 8 bit data IF
Number of Colors	18bit Normal
	3bit Partial
Size	26,7mm x 36,6mm x 1,8mm
Illumination	2 white LEDs in series
	100 cd/m²
Active Pixel area	21.50 mm x 26.88 mm
Viewing Angle	Normal 6, other 3, 9, 12 o'clock

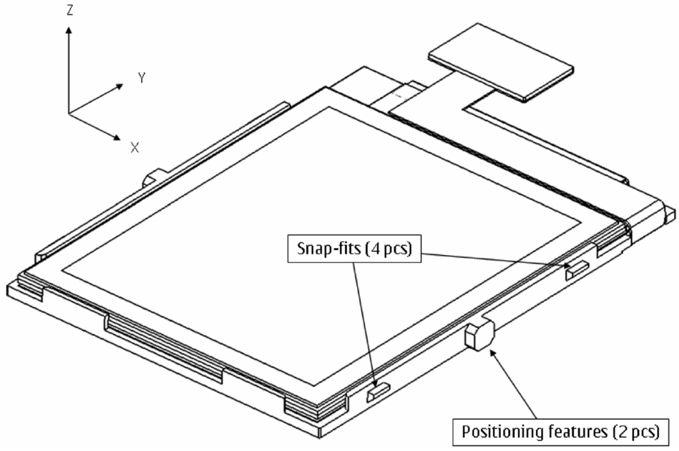


Figure 105 Cover UI display mechanical outline

Keyboard and other keys

The keyboard interface of RAPIDO supports 8x8 keyboard matrix. In this phone only a subset of 5 cols and 6 rows are used. The keyboard is part of the UI PWB and the side keys are placed on the engine PWB. All keys are connected to same key matrix made by the RAPIDO GENIOs apart from cover UI keys (music keys). They are connected to RAPIDO separately without any matrix.

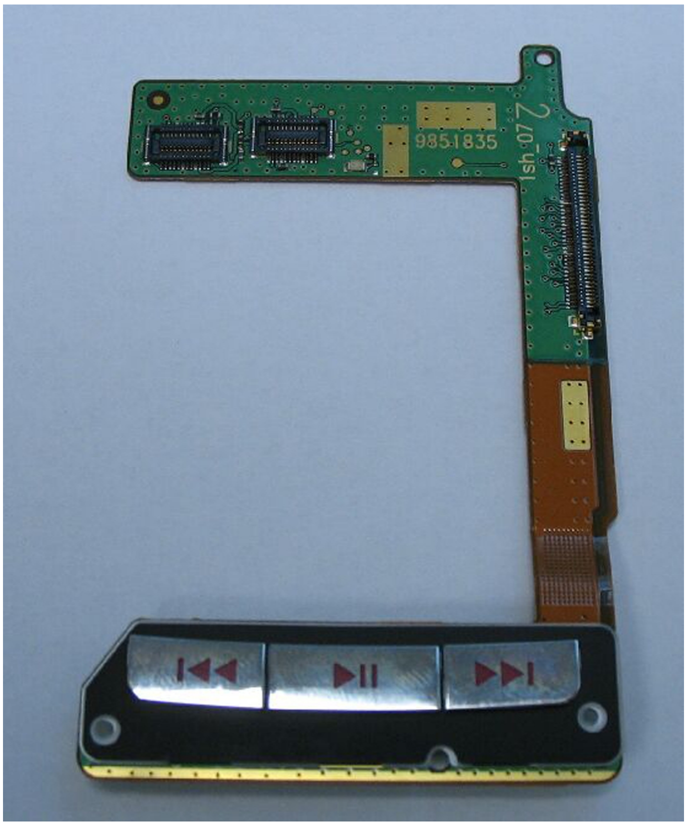


Figure 106 Cover user interface keys

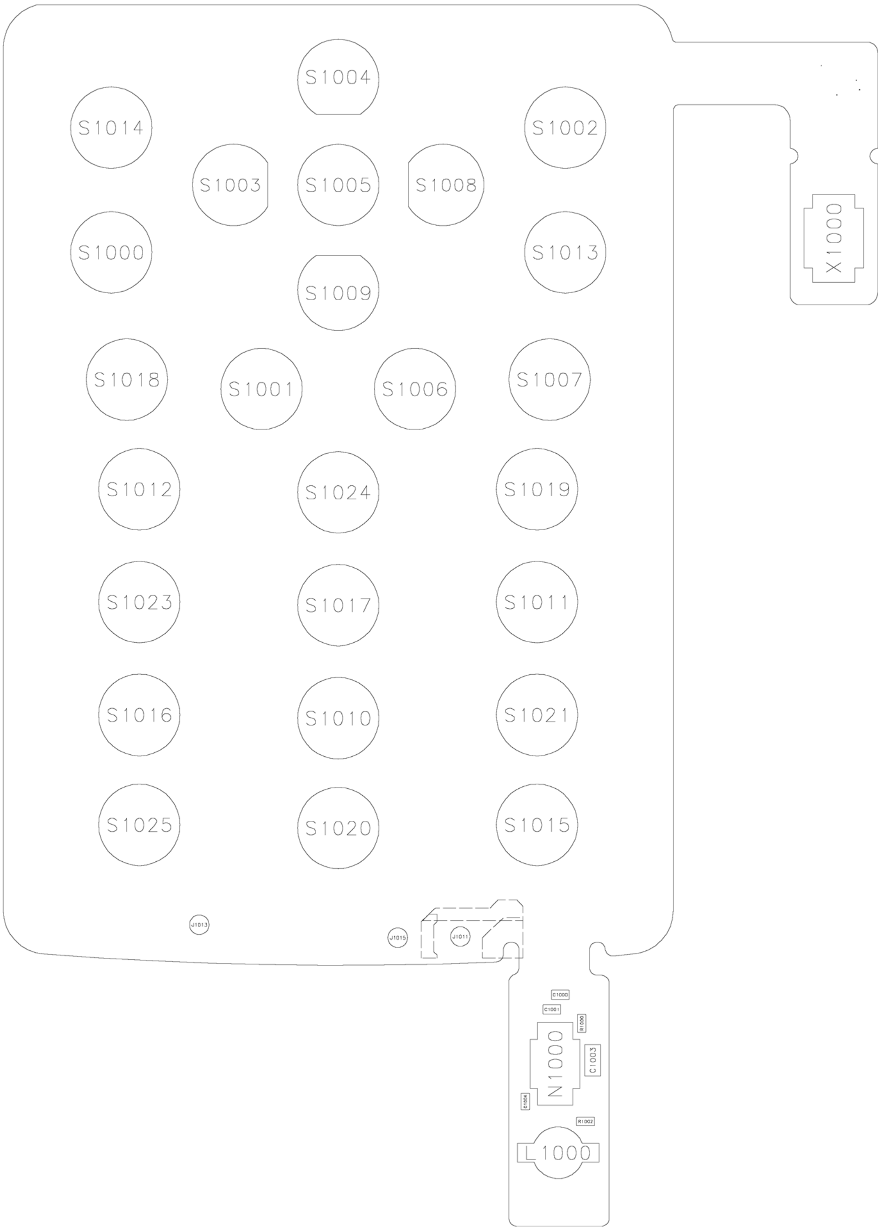

S1004
S1014
S1002
S1003
S1005
S1008
S1000
S1013
S1009
S1018
S1001
S1006
S1007
S1012
S1024
S1019
S1023
S1017
S1011
S1016
S1010
S1021
S1025
S1020
S1015
X1000
J1013
J1015
J1011
C1000
C1001
R1000
N1000
C1003
C1004
R1002
L1000

Figure 107 Keyboard layout

Table 9 UI and side keys

	Col 0	Col 1	Col 2	Col 3	Col 4
Row 0	S1004/Up (*)	S1003/Left (*)	S1002/R-Soft (*)	S1001/Pen (*)	S1000/Appl (*)
Row 1	S1009/Down (*)	S1008/Right (*)	S1007/End (*)	S1006/Clear (*)	S1005/Select (*)
Row 2	S1014/L-Soft (*)	S1013/Molt (*)	S1012/1 (*)	S1011/6 (*)	S1010/8 (*)
Row 3	S1018/Send (*)		S1017/5 (*)	S1016/7 (*)	S1015/# (*)
Row 4	S2401/Vol+ (**)	S2402/Vol- (**)	S1021/9 (*)	S1020/0 (*)	S1019/3 (*)
Row 5	S2404/IBU (**)	S2403/Shutter (**)	S1025/* (*)	S1024/2 (*)	S1023/4 (*)

Note: (*) = UI PWB
(**) = Engine PWB

Table 10 Cover UI keys

	GENIO 38	GENIO 39	GENIO 40
GND	S1000/REW	S1001/Play	S1002/FF

Backlight and illumination

Display and cover UI key illumination

Phone illumination diagram for both displays and cover keys is shown in figure below. The external regulator is controlled by Betty. It drives either the main display or both cover UI display and cover UI LEDs at the same time. This depends on the GENIO28 state, controlled by Rapido. The current is limited by the feedback regulator resistor. It is set to 18mA.

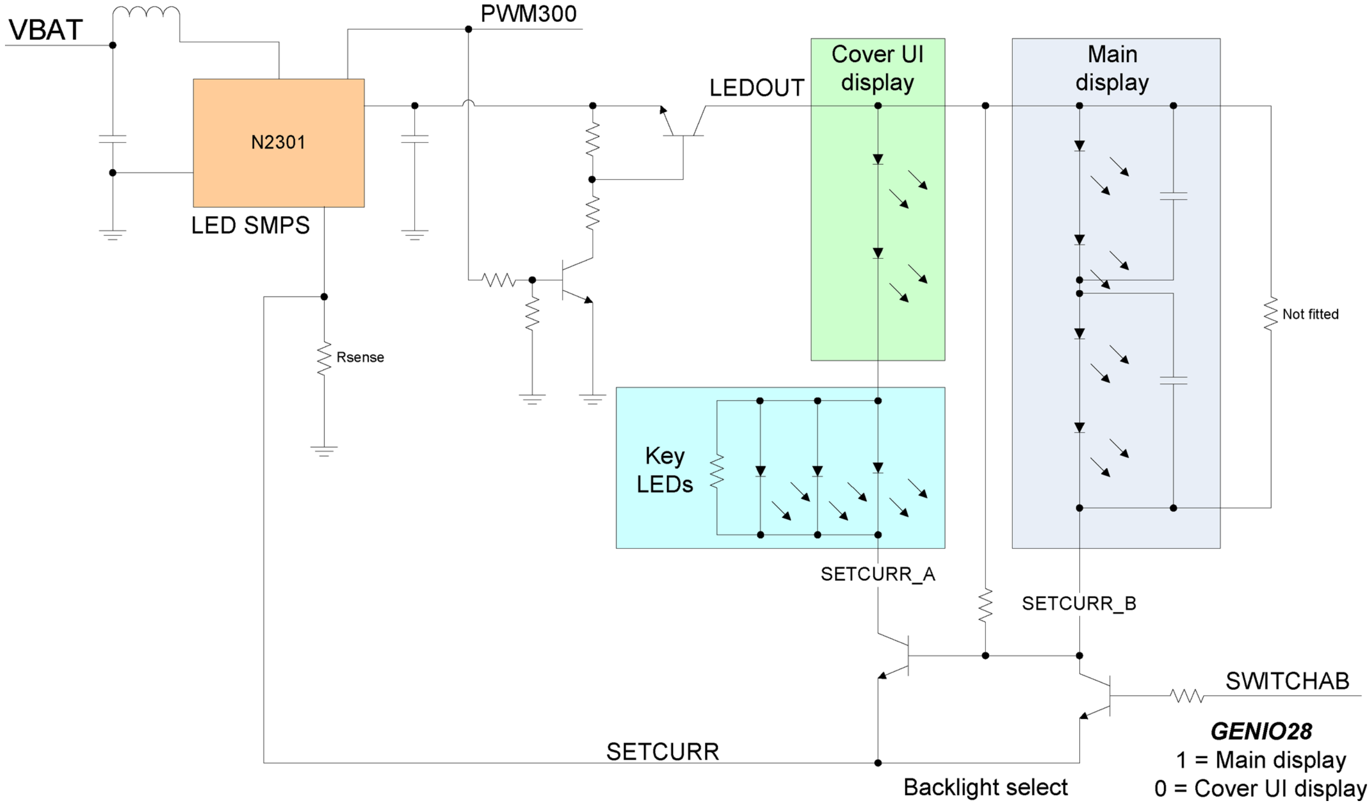

VBAT
PWM300
N2301
LED SMPS
LEDOUT
Cover UI display
Main display
Not fitted
Rsense
Key LEDs
SETCURR_A
SETCURR_B
SWITCHAB
GENIO28
1 = Main display
0 = Cover UI display
SETCURR
Backlight select

Figure 108 Illumination overview

Keyboard illumination

In order to get the required thickness, the keyboard is illuminated by EL foil instead of LEDs. The EL foil is flexible and located between keydomes and the keymat. It is based on electroluminescent material: this emits light if electrostatic field is caused by high voltage AC. It means a special regulator is needed. Handle it with care!

> **Note:** To avoid electrostatic shocks don't touch regulator circuit if EL foil emits light!

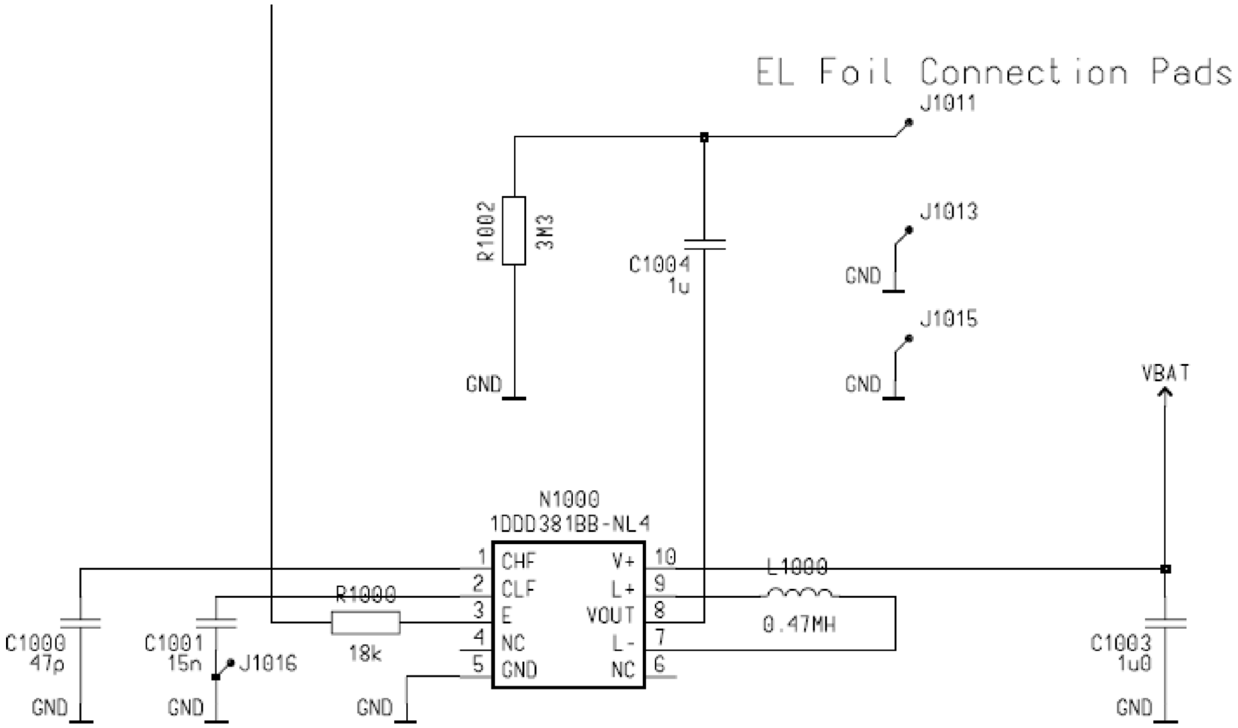

EL Foil Connection Pads
J1011
J1013
J1015
GND
GND
R1002
3M3
C1004
1u
GND
VBAT
N1000
1DDD381BB-NL4
1 CHF
2 CLF
3 E
4 NC
5 GND
10 V+
9 L+
8 VOUT
7 L-
6 NC
L1000
0.47MH
R1000
18k
C1000
47p
C1001
15n
J1016
C1003
1u0
GND
GND
GND
GND

Figure 109 High voltage regulator circuit

Power LED

In order to save current and increase the standby time, the phone provides an extra power saving mode where both displays will be switched off after a certain time of user inactivity. A low frequently blinking LED will indicate, that the phone is still alive (no empty battery).

The LED is located in the lid part adjacent to the cover UI display. In order to save the signal count on the engine-lid interface, a high side driver is used. The current through the LED is limited to ~2mA. The driver will be enabled by RAPIDO high active GENIO 54.

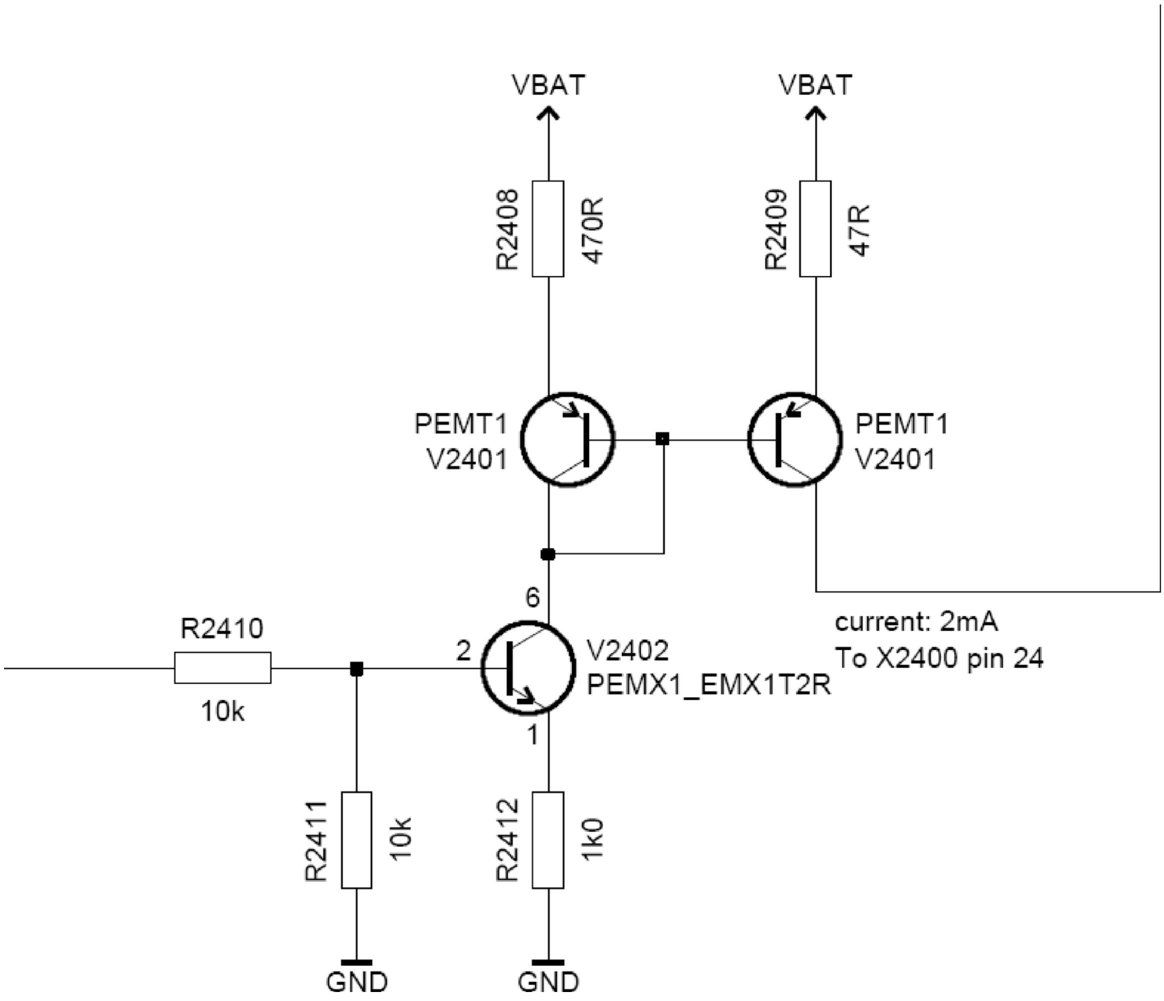

VBAT
VBAT
R2408
470R
R2409
47R
PEMT1
V2401
PEMT1
V2401
6
R2410
10k
2
V2402
PEMX1_EMX1T2R
1
current: 2mA
To X2400 pin 24
R2411
10k
R2412
1k0
GND
GND

Figure 110 Power LED high side driver

MR sensor

MR sensor is used to monitor the position of the upper block in fold construction.

MR sensor detects the fold position. There is a magnet in fold mechanics under the display module and when the fold is closed MR sensor is in magnetic field.

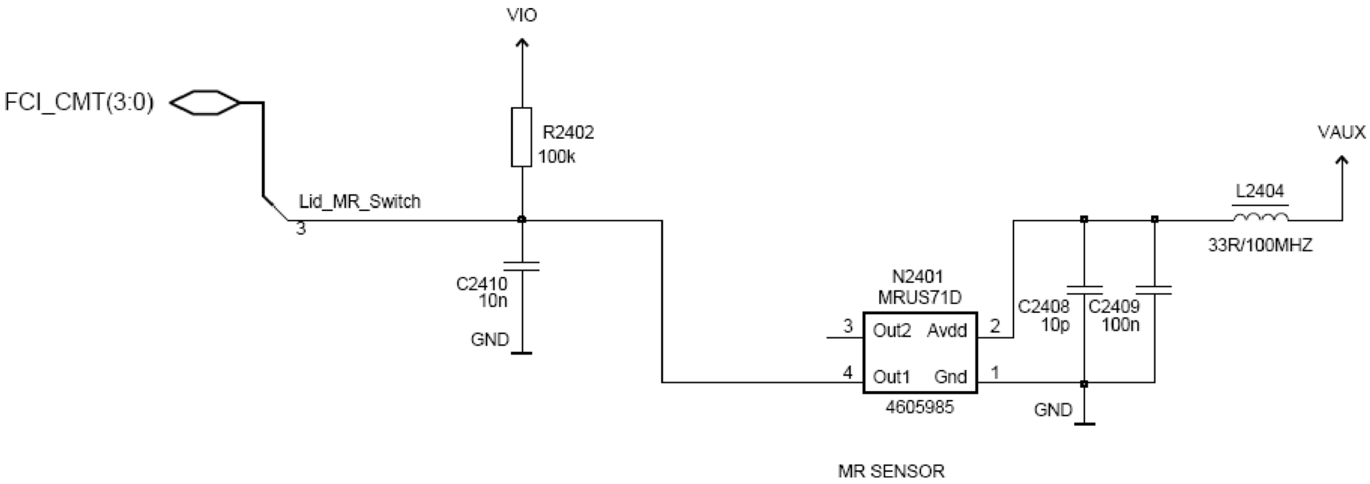

VIO
FCI_CMT(3:0)
R2402
100k
Lid_MR_Switch
3
C2410
10n
GND
VAUX
L2404
33R/100MHZ
N2401
MRUS71D
3
Out2
Avdd
2
4
Out1
Gnd
1
4605985
C2408
10p
C2409
100n
GND
MR SENSOR

Figure 111 MR sensor connection

ASICs

RAPIDO ASIC

Rapido ASIC is a 3G Radio Application Processor. RAM memory is integrated into Rapido.

EM ASIC N2300

The EM ASIC (N2300) includes the following functional blocks:

- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- LED driver for backlights
- Digital interface (CBUS)

EM ASIC N2200

The EM ASIC (N2200) includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

EMC ASIP (Appcation Specified Integrated Passive) have been integrated inside the ASIC. It includes biasing passives for microphone , EMC filter for SIM, microphones etc.

Device memories

RAPIDO memories NOR flash and SDRAM

Modem memory consists of 128 Mbit SDRAM and 128 Mbit NOR flash memories.

Combo memory

The application memory of the device consists of NAND/DDR combo memory. The stacked DDR/NAND application memory has 768 Mbit of DDR memory and 1 Gbit of flash memory.

Audio concept

Audio HW architecture

The functional core of the audio hardware is built around two ASICs: Rapido engine ASIC and the mixed signal ASIC AVilma. AVilma provides an interface for the transducers and the accessory connector. Because audio amplifiers are also integrated into the ASIC, the only discrete electronics components needed for audio paths are audio filtering components and EMC/ESD components.

There are three audio transducers:

- Dynamic earpiece
- Dynamic IHF speaker
- Microphone

In addition to the audio transducers, AVilma also provides an output for the dynamic vibra component. All galvanic audio accessories are connected to the AV accessory connector A Bluetooth audio and FM radio module, which is connected to the Rapido ASIC supports Bluetooth audio and FM radio functionality.

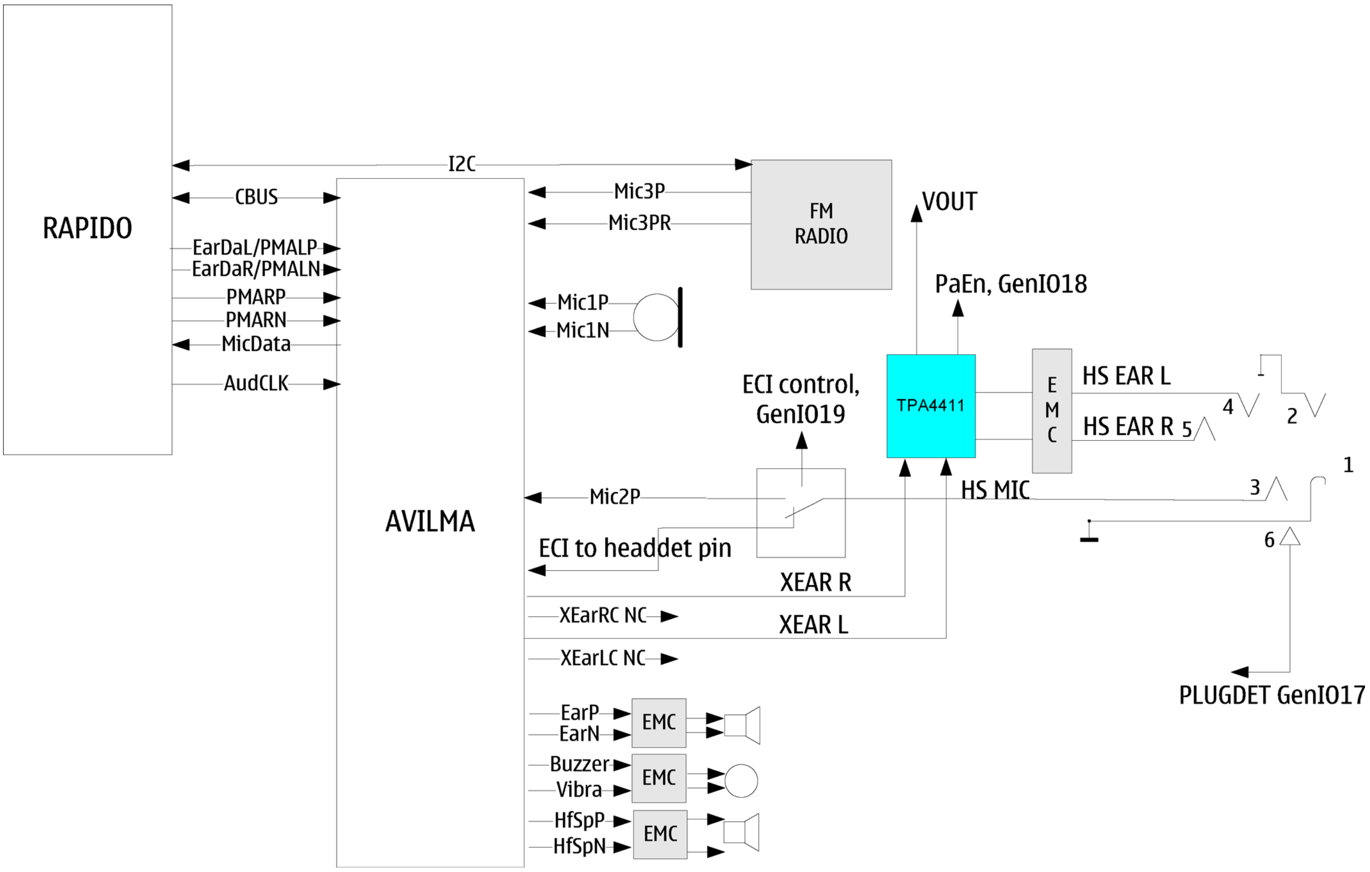

RAPIDO
I2C
CBUS
EarDaL/PMALP
EarDaR/PMALN
PMARP
PMARN
MicData
AudCLK
AVILMA
Mic3P
Mic3PR
FM RADIO
VOUT
PaEn, GenIO18
Mic1P
Mic1N
ECI control, GenIO19
TPA4411
E M C
HS EAR L
HS EAR R
4
2
5
1
3
6
Mic2P
HS MIC
ECI to headdet pin
XEAR R
XEarRC NC
XEAR L
XEarLC NC
PLUGDET GenIO17
EarP
EarN
EMC
Buzzer
Vibra
EMC
HfSpP
HfSpN
EMC

Figure 112 Audio block diagram

Internal microphone

The internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

An analogue electret microphone is connected to EM ASIC's (N2200) Mic1P input via asymmetric electrical connection.

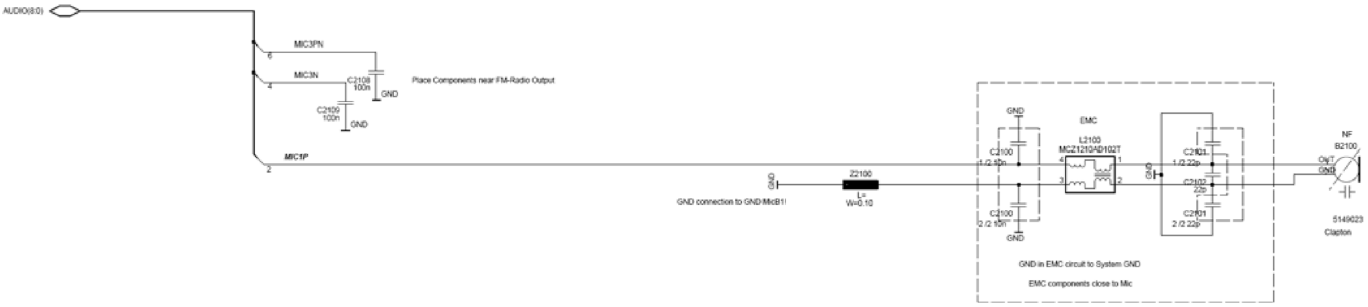

AUDIO(8:0)
MIC3PN
MIC3N
C2108 100n
C2109 100n
GND
Place Components near FM-Radio Output
MIC1P
Z2100
GND connection to GND/MicB1!
EMC
L2100
MCZ1210AD102T
GND in EMC circuit to System GND
EMC components close to Mic
B2100
5149023
Clapton

Figure 113 Internal microphone circuitry

External microphone

Galvanic accessories are connected to the AV connector.

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

External microphone circuitry is biased by Vilma ASIC MicB2 bias voltage output. The circuitry provides an asymmetrical connection for the microphone from the AV-connector, XMICP to Vilma ASIC input, mic2p and XMICN, to GND.

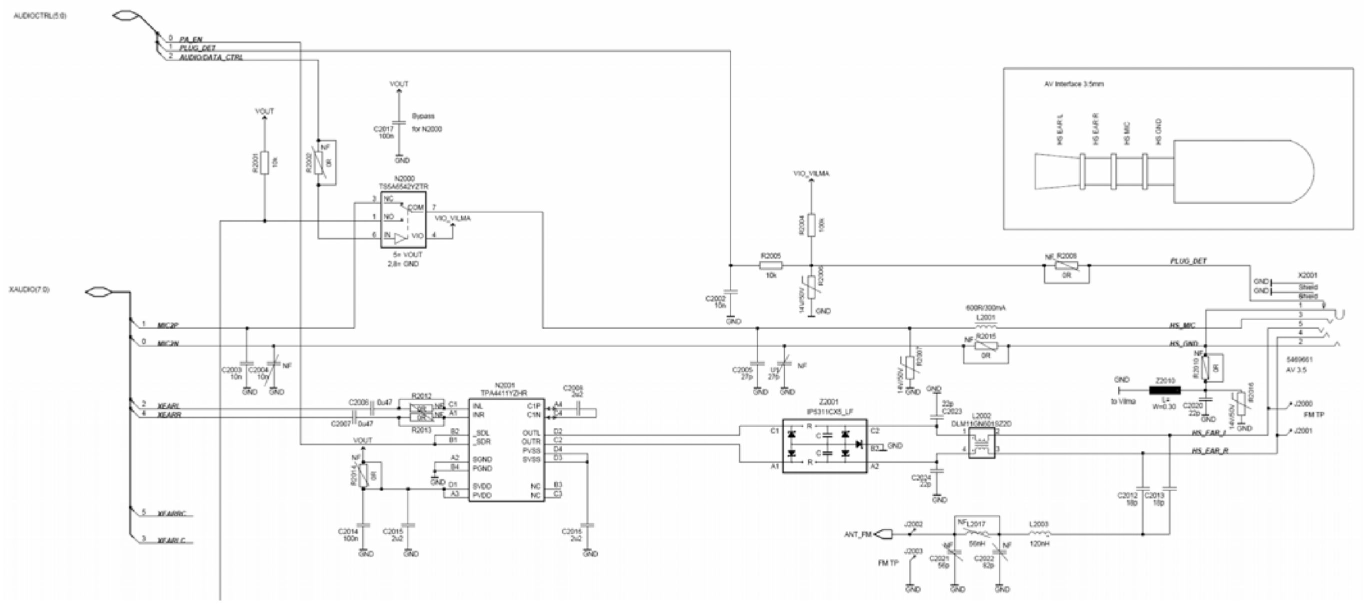
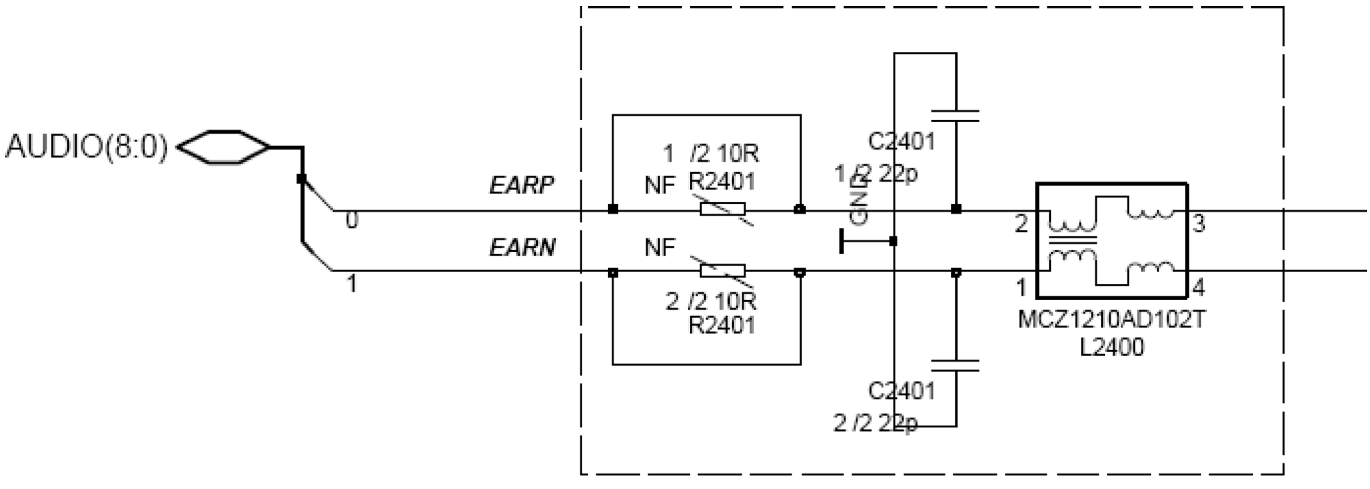

AUDIOCTRL(5:0)
PA_EN
PLUG_DET
AUDIO/DATA_CTRL
VOUT
N2000
TS5A6542YZTR
VIO_VILMA
XAUDIO(7:0)
MIC2P
MIC2N
XEARL
XEARR
XEARRC
XEARLC
N2001
TPA4411YZHR
Z2001
IP5311CX5_LF
L2002
DLM11GN601SZ20
AV Interface 3.5mm
HS EAR L
HS EAR R
HS MIC
HS GND
PLUG_DET
HS_MIC
HS_GND
HS_EAR_L
HS_EAR_R
X2001
5469661
AV 3.5
ANT_FM
FM TP
Z2010
to Vilma

Figure 114 External earpiece and microphone circuitry

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic 7x11 mm earpiece capsule is connected to Avilma ASIC’s differential output EarP and EarN.


AUDIO(8:0)
EARP
EARN
0
1
NF
1 /2 10R
R2401
NF
2 /2 10R
R2401
C2401
1 /2 22p
GND
C2401
2 /2 22p
2
3
1
4
MCZ1210AD102T
L2400

Close to Vilma

Figure 115 Internal earpiece circuitry (engine side)

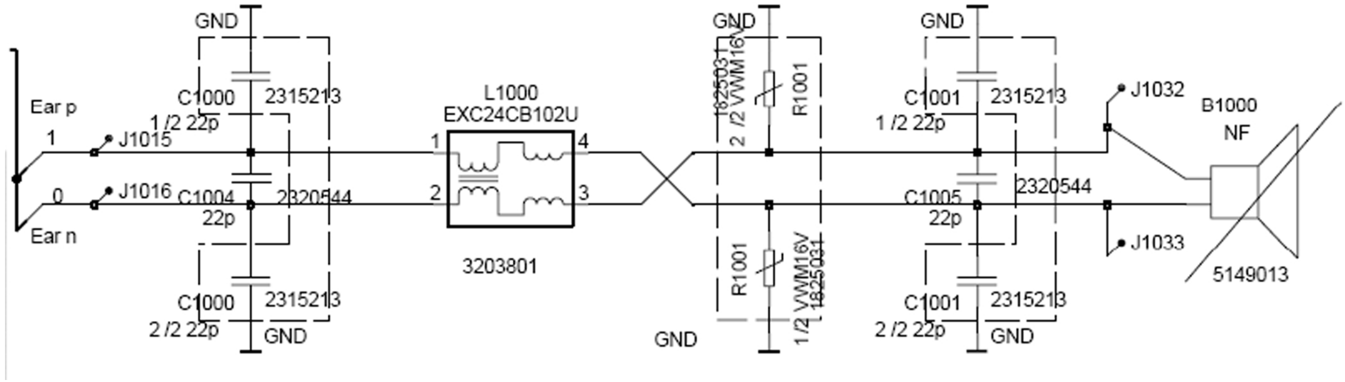

GND
Ear p
1
J1015
0
J1016
Ear n
C1000
1 /2 22p
2315213
C1004
22p
2320544
C1000
2 /2 22p
2315213
GND
L1000
EXC24CB102U
1
2
4
3
3203801
GND
1825031
2 /2 VWM16V
R1001
R1001
1 /2 VWM16V
1825031
GND
GND
C1001
1 /2 22p
2315213
C1005
22p
2320544
C1001
2 /2 22p
2315213
GND
J1032
J1033
B1000
NF
5149013

Figure 116 Internal earpiece circuitry (lid side)

Internal speaker

The internal speaker is used for Internal HandsFree (IHF) call mode, video call, ringing tones, FM radio and music listening.

A dynamic 15x11 mm speaker is connected to EM ASIC’s (N2200) outputs HFSpP and HFSpN. The IHF amplifier integrated in N2200 is a Digital Pulse Modulated Amplifier (DPMA).

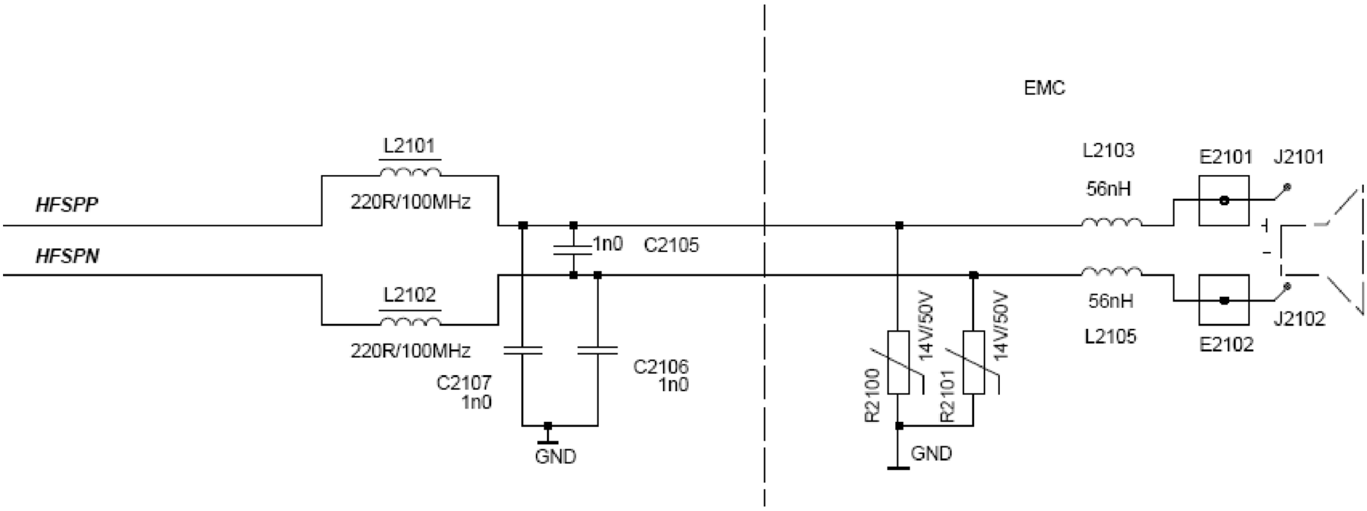

EMC
HFSPP
HFSPN
L2101
220R/100MHz
L2102
220R/100MHz
1n0
C2105
C2107
1n0
C2106
1n0
GND
R2100
14V/50V
R2101
14V/50V
GND
L2103
56nH
56nH
L2105
E2101
J2101
E2102
J2102

Figure 117 Internal speaker circuitry

External earpiece

Galvanic accessories are connected to the AV connector.

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

The Avilma ASIC provides two output channels in either single-ended or differential format. The Avilma ASIC outputs XearL and XearLC form the left channel audio output and XearR and XearRC the right channel audio output. XearLC and XearRC are the ground pins if the output works in a single-ended operation.

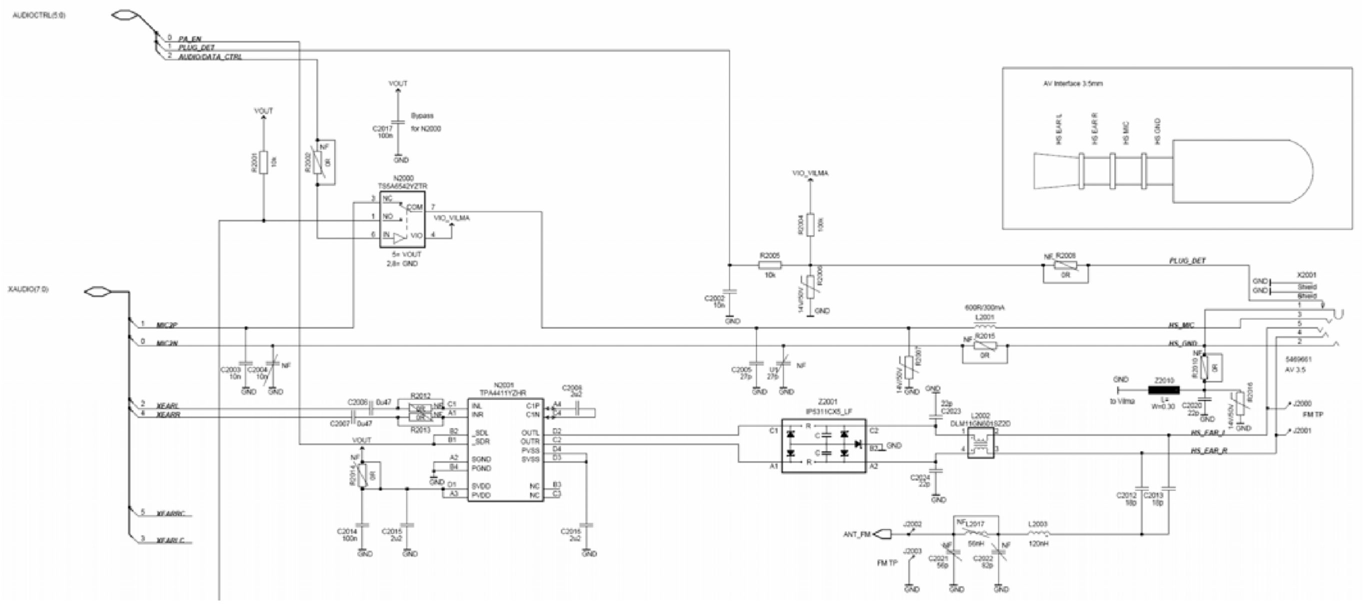

AUDIOCTRL(5:0)
PA_EN
PLUG_DET
AUDIO/DATA_CTRL
XAUDIO(7:0)
MIC2P
MIC2N
XEARL
XEARR
XEARRC
XEARLC
N2000
N2001
TPA4411YZHR
Z2001
AV Interface 3.5mm
PLUG_DET
HS_MIC
HS_GND
HS_EAR_L
HS_EAR_R
X2001
ANT_FM
VIO_VILMA
VOUT
GND

Figure 118 External earpiece and microphone circuitry

Vibra circuitry

Vibra is used for the vibra alarm function.

The vibra motor is connected to the Avilma ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.

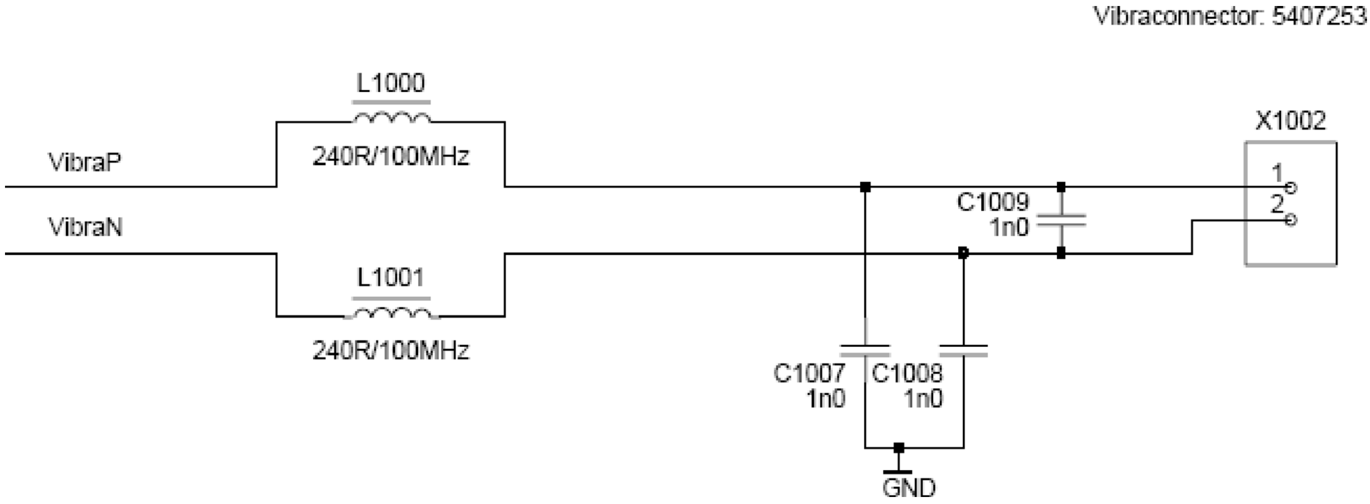

Vibraconnector: 5407253
L1000
240R/100MHz
VibraP
VibraN
L1001
240R/100MHz
X1002
1
2
C1009
1n0
C1007
1n0
C1008
1n0
GND

Figure 119 Vibra circuitry

AV connector

The AV connector consists of single ended mono or stereo audio output and mono audio input.

The handsfree driver in Avilma is meant for the headset.

Table 11 AV interface electrical characteristics

Signal name	Function/ Parameter	Min	Typ	Max	Unit	Notes
HSMIC	HS mic audio input	-	-	1.3 V_{pp}	V	Max. negative level - 0.7 V
HSEARL	HS EAR L audio output	-	-	2 V_{pp}	V	SPR requirement
HSEARR	HS EAR R audio output	-	-	2 V_{pp}	V	SPR requirement
MICBIAS	HS MIC bias voltage	2.05	2.1	2.25	V	
ECI	Vin high	1.7	-	2.6	V	
ECI	Vin low	0	-	0.7	V	

Baseband technical specifications

External interfaces

Name of connection	Connector reference
USB	X2002 (on engine PWB)
Charger plug	X2000
AV connector (Headset)	X2001 (on engine PWB)
SIM reader	X2700 (on engine PWB)
Micro SD reader	X3000 (on engine PWB)
Battery connector	X2070 (on engine PWB)

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	VSIM	Out	EM ASIC N2200	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
C2	SIMRST	Out	EM ASIC N2200	SIMRstC1	Reset signal to SIM card
C3	SIMCLK	Out	EM ASIC N2200	SIMClkC1	Clock signal to SIM card
C5	GND	-	GND		Ground
C7	SIMDATA	In/Out	EM ASIC N2200	SIMDaC1	Data input /output

Charger connector and charging interface connections & electrical characteristics

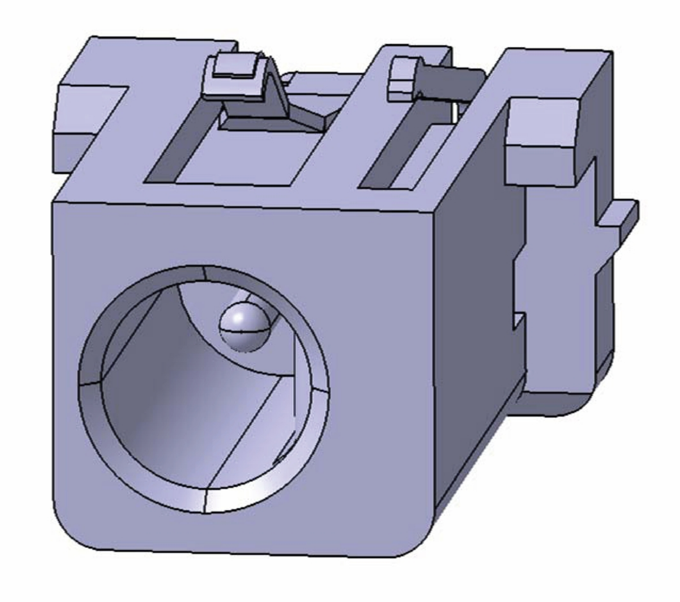


Figure 120 Charger connector

Table 12 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	N2300	VCharIn1 VCharIn2 VCharInK	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 13 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	16	V	Limit is given by suppressor diode
Vchar	I Charge		1.1	A	Value valid for PWM mode charge current
Charge GND			1.1	A	Value valid for PWM mode charge current

Internal interfaces

Name of Connection	Connector reference	Module
IHF speaker connector	J2101, J2102	Engine assembly
Microphone connector	B2100	Engine assembly
BTB connector (Engine side)	X2401	Engine assembly
BTB connector (UI side)	X1000	UI PWB
BTB connector (Engine side)	X2500	Engine assembly
BTB connector (Camera side)	X1001	Camera PWB
Main camera connector	X1000	
Vibra connector	X1002	
Coax connector (Engine side)	X2400	Engine assembly
Coax connector (LID side)	X1001	Lid assembly
Main display connector	X1000	
Cover UI display connector	X1002	
Earpiece connector	B1000	

Back-up battery interface electrical characteristics

Table 14 Back-up battery connections

Pin name	I/O	Connection	Notes
VBACK	<->	N2200 - VBACK	Back-up battery G2200 is connected to N2200 directly

Table 15 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback			2.6	V

RF description

Block diagram

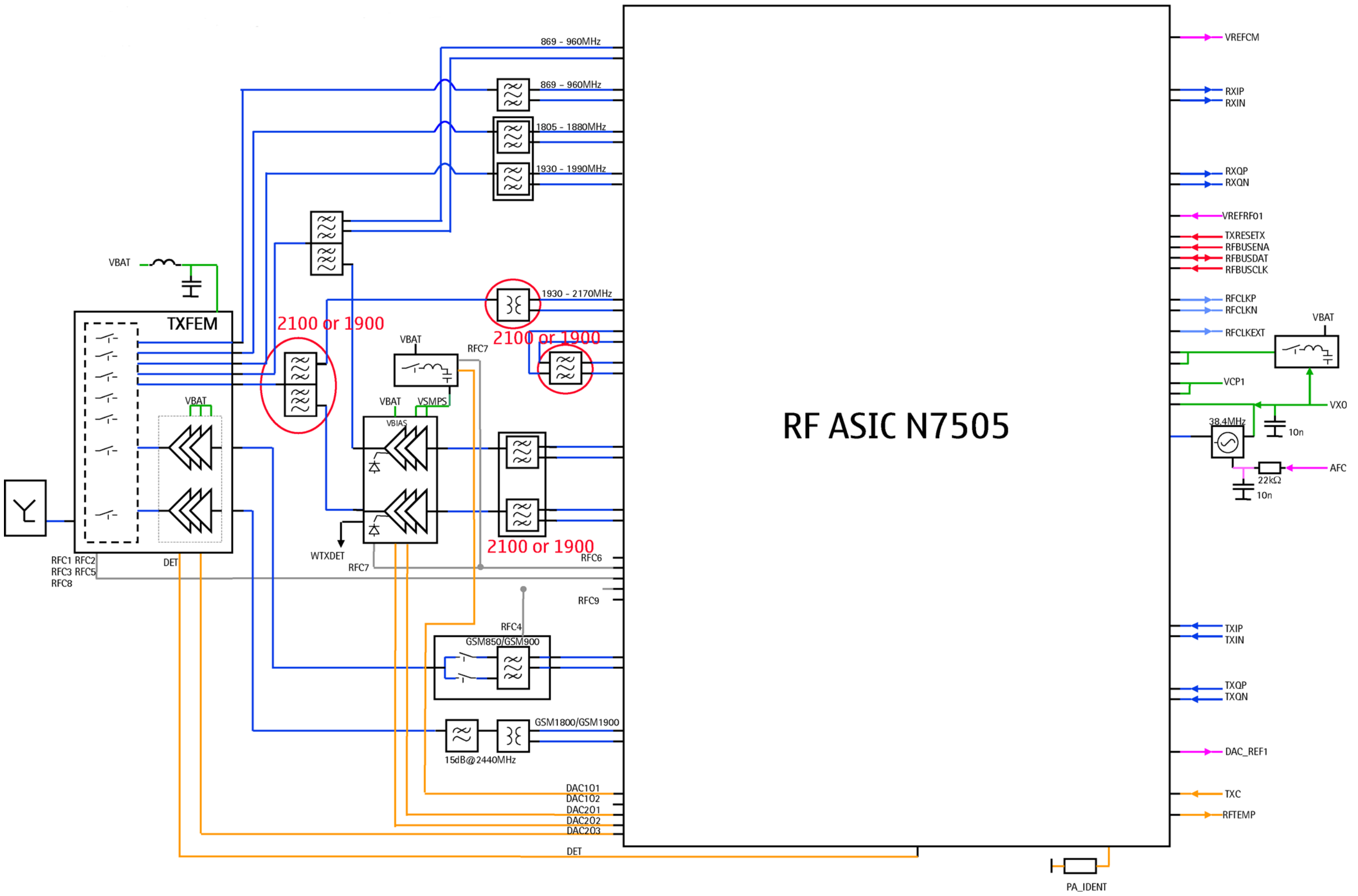

869 - 960MHz
869 - 960MHz
1805 - 1880MHz
1930 - 1990MHz
1930 - 2170MHz
VBAT
TXFEM
2100 or 1900
2100 or 1900
2100 or 1900
VBAT
RFC7
VBAT
VSMPS
VBIAS
WTXDET
RFC7
RFC1 RFC2
RFC3 RFC5
RFC8
DET
RFC6
RFC9
RFC4
GSM850/GSM900
GSM1800/GSM1900
15dB@2440MHz
DAC101
DAC102
DAC201
DAC202
DAC203
DET
RF ASIC N7505
VREFCM
RXIP
RXIN
RXQP
RXQN
VREFRF01
TXRESETX
RFBUSENA
RFBUSDAT
RFBUSCLK
RFCLKP
RFCLKN
RFCLKEXT
VBAT
VCP1
VXO
38.4MHz
10n
AFC
22kΩ
10n
TXIP
TXIN
TXQP
TXQN
DAC_REF1
TXC
RFTEMP
PA_IDENT

Figure 121 RF block diagram using RF ASIC N7505

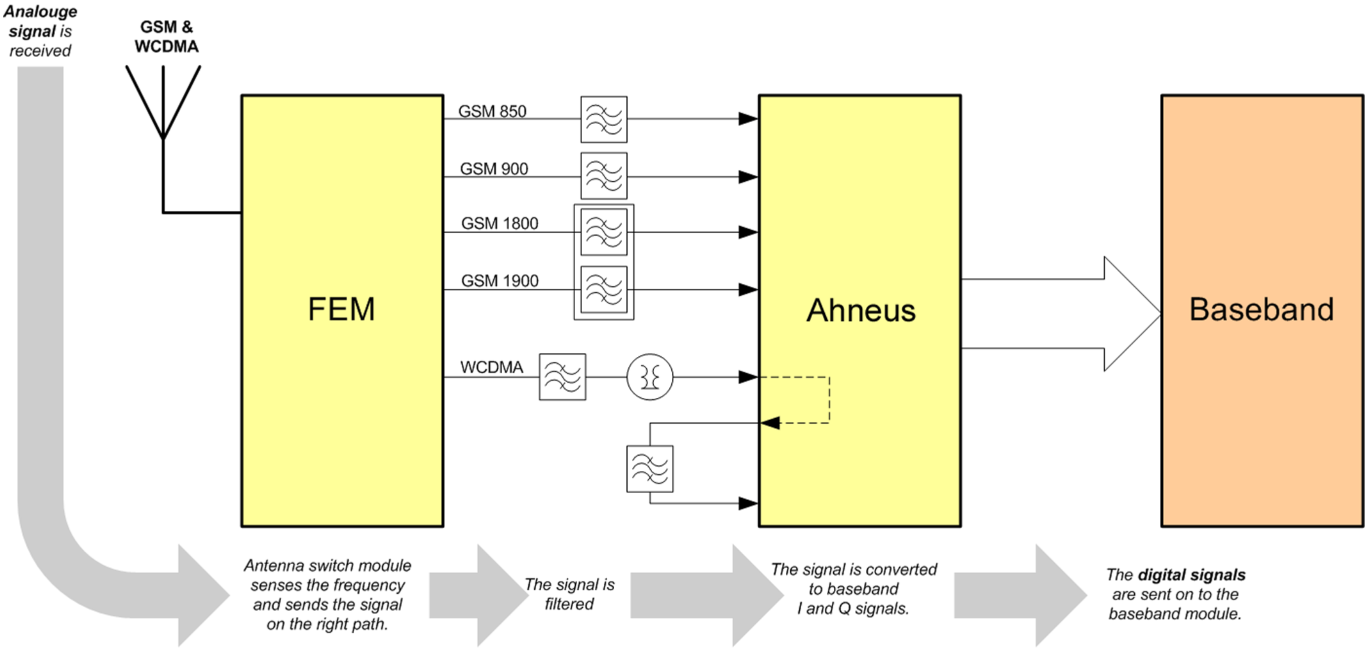
The RF block diagram uses RF ASIC N7505 that performs the RF back-end functions of receive and transmit function of the cellular transceiver.

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

Signals with different frequencies take different "ways", being handled by different components. The principle of GSM and WCDMA is the same.

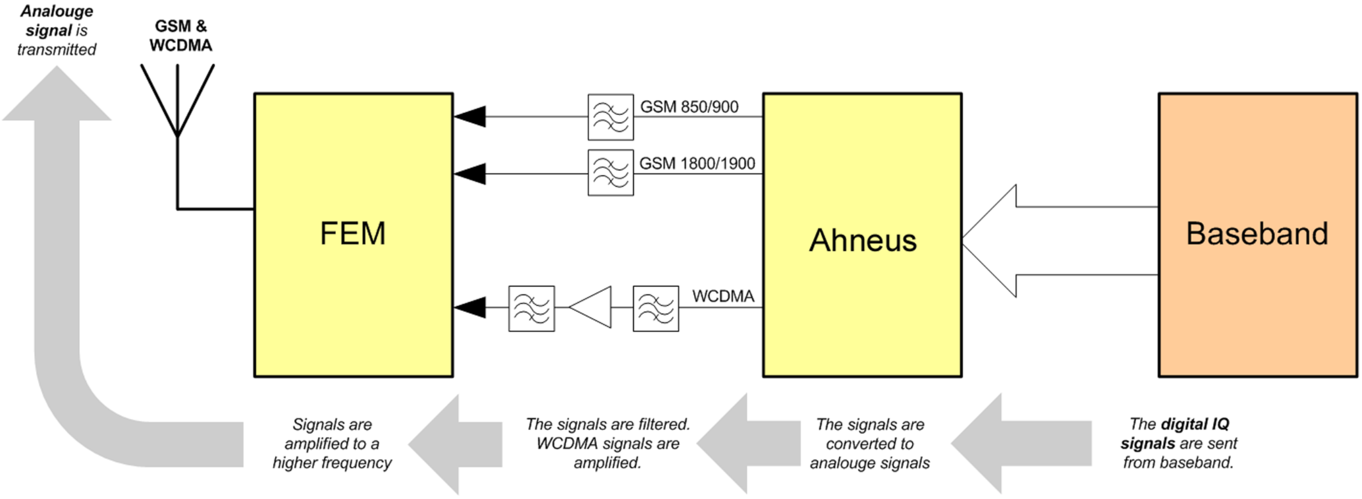

Analouge signal is received
GSM & WCDMA
FEM
GSM 850
GSM 900
GSM 1800
GSM 1900
WCDMA
Ahneus
Baseband
Antenna switch module senses the frequency and sends the signal on the right path.
The signal is filtered
The signal is converted to baseband I and Q signals.
The digital signals are sent on to the baseband module.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwidth of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.

Even though the GSM and WCDMA signals pass different components, the principles of the transmission is the same.


Analouge signal is transmitted
GSM & WCDMA
FEM
GSM 850/900
GSM 1800/1900
WCDMA
Ahneus
Baseband
Signals are amplified to a higher frequency
The signals are filtered. WCDMA signals are amplified.
The signals are converted to analouge signals
The digital IQ signals are sent from baseband.

Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

WCDMA 2100 Rx frequencies

Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX
10562	2112.4	4224.8	10625	2125	4250	10688	2137.6	4275.2	10751	2150.2	4300.4	10814	2162.8	4325.6
10563	2112.6	4225.2	10626	2125.2	4250.4	10689	2137.8	4275.6	10752	2150.4	4300.8	10815	2163	4326
10564	2112.8	4225.6	10627	2125.4	4250.8	10690	2138	4276	10753	2150.6	4301.2	10816	2163.2	4326.4
10565	2113	4226	10628	2125.6	4251.2	10691	2138.2	4276.4	10754	2150.8	4301.6	10817	2163.4	4326.8
10566	2113.2	4226.4	10629	2125.8	4251.6	10692	2138.4	4276.8	10755	2151	4302	10818	2163.6	4327.2
10567	2113.4	4226.8	10630	2126	4252	10693	2138.6	4277.2	10756	2151.2	4302.4	10819	2163.8	4327.6
10568	2113.6	4227.2	10631	2126.2	4252.4	10694	2138.8	4277.6	10757	2151.4	4302.8	10820	2164	4328
10569	2113.8	4227.6	10632	2126.4	4252.8	10695	2139	4278	10758	2151.6	4303.2	10821	2164.2	4328.4
10570	2114	4228	10633	2126.6	4253.2	10696	2139.2	4278.4	10759	2151.8	4303.6	10822	2164.4	4328.8
10571	2114.2	4228.4	10634	2126.8	4253.6	10697	2139.4	4278.8	10760	2152	4304	10823	2164.6	4329.2
10572	2114.4	4228.8	10635	2127	4254	10698	2139.6	4279.2	10761	2152.2	4304.4	10824	2164.8	4329.6
10573	2114.6	4229.2	10636	2127.2	4254.4	10699	2139.8	4279.6	10762	2152.4	4304.8	10825	2165	4330
10574	2114.8	4229.6	10637	2127.4	4254.8	10700	2140	4280	10763	2152.6	4305.2	10826	2165.2	4330.4
10575	2115	4230	10638	2127.6	4255.2	10701	2140.2	4280.4	10764	2152.8	4305.6	10827	2165.4	4330.8
10576	2115.2	4230.4	10639	2127.8	4255.6	10702	2140.4	4280.8	10765	2153	4306	10828	2165.6	4331.2
10577	2115.4	4230.8	10640	2128	4256	10703	2140.6	4281.2	10766	2153.2	4306.4	10829	2165.8	4331.6
10578	2115.6	4231.2	10641	2128.2	4256.4	10704	2140.8	4281.6	10767	2153.4	4306.8	10830	2166	4332
10579	2115.8	4231.6	10642	2128.4	4256.8	10705	2141	4282	10768	2153.6	4307.2	10831	2166.2	4332.4
10580	2116	4232	10643	2128.6	4257.2	10706	2141.2	4282.4	10769	2153.8	4307.6	10832	2166.4	4332.8
10581	2116.2	4232.4	10644	2128.8	4257.6	10707	2141.4	4282.8	10770	2154	4308	10833	2166.6	4333.2
10582	2116.4	4232.8	10645	2129	4258	10708	2141.6	4283.2	10771	2154.2	4308.4	10834	2166.8	4333.6
10583	2116.6	4233.2	10646	2129.2	4258.4	10709	2141.8	4283.6	10772	2154.4	4308.8	10835	2167	4334
10584	2116.8	4233.6	10647	2129.4	4258.8	10710	2142	4284	10773	2154.6	4309.2	10836	2167.2	4334.4
10585	2117	4234	10648	2129.6	4259.2	10711	2142.2	4284.4	10774	2154.8	4309.6	10837	2167.4	4334.8
10586	2117.2	4234.4	10649	2129.8	4259.6	10712	2142.4	4284.8	10775	2155	4310	10838	2167.6	4335.2
10587	2117.4	4234.8	10650	2130	4260	10713	2142.6	4285.2	10776	2155.2	4310.4			
10588	2117.6	4235.2	10651	2130.2	4260.4	10714	2142.8	4285.6	10777	2155.4	4310.8			
10589	2117.8	4235.6	10652	2130.4	4260.8	10715	2143	4286	10778	2155.6	4311.2			
10590	2118	4236	10653	2130.6	4261.2	10716	2143.2	4286.4	10779	2155.8	4311.6			
10591	2118.2	4236.4	10654	2130.8	4261.6	10717	2143.4	4286.8	10780	2156	4312			
10592	2118.4	4236.8	10655	2131	4262	10718	2143.6	4287.2	10781	2156.2	4312.4			
10593	2118.6	4237.2	10656	2131.2	4262.4	10719	2143.8	4287.6	10782	2156.4	4312.8			
10594	2118.8	4237.6	10657	2131.4	4262.8	10720	2144	4288	10783	2156.6	4313.2			
10595	2119	4238	10658	2131.6	4263.2	10721	2144.2	4288.4	10784	2156.8	4313.6			
10596	2119.2	4238.4	10659	2131.8	4263.6	10722	2144.4	4288.8	10785	2157	4314			
10597	2119.4	4238.8	10660	2132	4264	10723	2144.6	4289.2	10786	2157.2	4314.4			
10598	2119.6	4239.2	10661	2132.2	4264.4	10724	2144.8	4289.6	10787	2157.4	4314.8			
10599	2119.8	4239.6	10662	2132.4	4264.8	10725	2145	4290	10788	2157.6	4315.2			
10600	2120	4240	10663	2132.6	4265.2	10726	2145.2	4290.4	10789	2157.8	4315.6			
10601	2120.2	4240.4	10664	2132.8	4265.6	10727	2145.4	4290.8	10790	2158	4316			
10602	2120.4	4240.8	10665	2133	4266	10728	2145.6	4291.2	10791	2158.2	4316.4			
10603	2120.6	4241.2	10666	2133.2	4266.4	10729	2145.8	4291.6	10792	2158.4	4316.8			
10604	2120.8	4241.6	10667	2133.4	4266.8	10730	2146	4292	10793	2158.6	4317.2			
10605	2121	4242	10668	2133.6	4267.2	10731	2146.2	4292.4	10794	2158.8	4317.6			
10606	2121.2	4242.4	10669	2133.8	4267.6	10732	2146.4	4292.8	10795	2159	4318			
10607	2121.4	4242.8	10670	2134	4268	10733	2146.6	4293.2	10796	2159.2	4318.4			
10608	2121.6	4243.2	10671	2134.2	4268.4	10734	2146.8	4293.6	10797	2159.4	4318.8			
10609	2121.8	4243.6	10672	2134.4	4268.8	10735	2147	4294	10798	2159.6	4319.2			
10610	2122	4244	10673	2134.6	4269.2	10736	2147.2	4294.4	10799	2159.8	4319.6			
10611	2122.2	4244.4	10674	2134.8	4269.6	10737	2147.4	4294.8	10800	2160	4320			
10612	2122.4	4244.8	10675	2135	4270	10738	2147.6	4295.2	10801	2160.2	4320.4			
10613	2122.6	4245.2	10676	2135.2	4270.4	10739	2147.8	4295.6	10802	2160.4	4320.8			
10614	2122.8	4245.6	10677	2135.4	4270.8	10740	2148	4296	10803	2160.6	4321.2			
10615	2123	4246	10678	2135.6	4271.2	10741	2148.2	4296.4	10804	2160.8	4321.6			
10616	2123.2	4246.4	10679	2135.8	4271.6	10742	2148.4	4296.8	10805	2161	4322			
10617	2123.4	4246.8	10680	2136	4272	10743	2148.6	4297.2	10806	2161.2	4322.4			
10618	2123.6	4247.2	10681	2136.2	4272.4	10744	2148.8	4297.6	10807	2161.4	4322.8			
10619	2123.8	4247.6	10682	2136.4	4272.8	10745	2149	4298	10808	2161.6	4323.2			
10620	2124	4248	10683	2136.6	4273.2	10746	2149.2	4298.4	10809	2161.8	4323.6			
10621	2124.2	4248.4	10684	2136.8	4273.6	10747	2149.4	4298.8	10810	2162	4324			
10622	2124.4	4248.8	10685	2137	4274	10748	2149.6	4299.2	10811	2162.2	4324.4			
10623	2124.6	4249.2	10686	2137.2	4274.4	10749	2149.8	4299.6	10812	2162.4	4324.8			
10624	2124.8	4249.6	10687	2137.4	4274.8	10750	2150	4300	10813	2162.6	4325.2			

WCDMA 2100 Tx frequencies

Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx
9612	1922.4	3844.8	9671	1934.2	3868.4	9730	1946	3892	9789	1957.8	3915.6	9848	1969.6	3939.2
9613	1922.6	3845.2	9672	1934.4	3868.8	9731	1946.2	3892.4	9790	1958	3916	9849	1969.8	3939.6
9614	1922.8	3845.6	9673	1934.6	3869.2	9732	1946.4	3892.8	9791	1958.2	3916.4	9850	1970	3940
9615	1923	3846	9674	1934.8	3869.6	9733	1946.6	3893.2	9792	1958.4	3916.8	9851	1970.2	3940.4
9616	1923.2	3846.4	9675	1935	3870	9734	1946.8	3893.6	9793	1958.6	3917.2	9852	1970.4	3940.8
9617	1923.4	3846.8	9676	1935.2	3870.4	9735	1947	3894	9794	1958.8	3917.6	9853	1970.6	3941.2
9618	1923.6	3847.2	9677	1935.4	3870.8	9736	1947.2	3894.4	9795	1959	3918	9854	1970.8	3941.6
9619	1923.8	3847.6	9678	1935.6	3871.2	9737	1947.4	3894.8	9796	1959.2	3918.4	9855	1971	3942
9620	1924	3848	9679	1935.8	3871.6	9738	1947.6	3895.2	9797	1959.4	3918.8	9856	1971.2	3942.4
9621	1924.2	3848.4	9680	1936	3872	9739	1947.8	3895.6	9798	1959.6	3919.2	9857	1971.4	3942.8
9622	1924.4	3848.8	9681	1936.2	3872.4	9740	1948	3896	9799	1959.8	3919.6	9858	1971.6	3943.2
9623	1924.6	3849.2	9682	1936.4	3872.8	9741	1948.2	3896.4	9800	1960	3920	9859	1971.8	3943.6
9624	1924.8	3849.6	9683	1936.6	3873.2	9742	1948.4	3896.8	9801	1960.2	3920.4	9860	1972	3944
9625	1925	3850	9684	1936.8	3873.6	9743	1948.6	3897.2	9802	1960.4	3920.8	9861	1972.2	3944.4
9626	1925.2	3850.4	9685	1937	3874	9744	1948.8	3897.6	9803	1960.6	3921.2	9862	1972.4	3944.8
9627	1925.4	3850.8	9686	1937.2	3874.4	9745	1949	3898	9804	1960.8	3921.6	9863	1972.6	3945.2
9628	1925.6	3851.2	9687	1937.4	3874.8	9746	1949.2	3898.4	9805	1961	3922	9864	1972.8	3945.6
9629	1925.8	3851.6	9688	1937.6	3875.2	9747	1949.4	3898.8	9806	1961.2	3922.4	9865	1973	3946
9630	1926	3852	9689	1937.8	3875.6	9748	1949.6	3899.2	9807	1961.4	3922.8	9866	1973.2	3946.4
9631	1926.2	3852.4	9690	1938	3876	9749	1949.8	3899.6	9808	1961.6	3923.2	9867	1973.4	3946.8
9632	1926.4	3852.8	9691	1938.2	3876.4	9750	1950	3900	9809	1961.8	3923.6	9868	1973.6	3947.2
9633	1926.6	3853.2	9692	1938.4	3876.8	9751	1950.2	3900.4	9810	1962	3924	9869	1973.8	3947.6
9634	1926.8	3853.6	9693	1938.6	3877.2	9752	1950.4	3900.8	9811	1962.2	3924.4	9870	1974	3948
9635	1927	3854	9694	1938.8	3877.6	9753	1950.6	3901.2	9812	1962.4	3924.8	9871	1974.2	3948.4
9636	1927.2	3854.4	9695	1939	3878	9754	1950.8	3901.6	9813	1962.6	3925.2	9872	1974.4	3948.8
9637	1927.4	3854.8	9696	1939.2	3878.4	9755	1951	3902	9814	1962.8	3925.6	9873	1974.6	3949.2
9638	1927.6	3855.2	9697	1939.4	3878.8	9756	1951.2	3902.4	9815	1963	3926	9874	1974.8	3949.6
9639	1927.8	3855.6	9698	1939.6	3879.2	9757	1951.4	3902.8	9816	1963.2	3926.4	9875	1975	3950
9640	1928	3856	9699	1939.8	3879.6	9758	1951.6	3903.2	9817	1963.4	3926.8	9876	1975.2	3950.4
9641	1928.2	3856.4	9700	1940	3880	9759	1951.8	3903.6	9818	1963.6	3927.2	9877	1975.4	3950.8
9642	1928.4	3856.8	9701	1940.2	3880.4	9760	1952	3904	9819	1963.8	3927.6	9878	1975.6	3951.2
9643	1928.6	3857.2	9702	1940.4	3880.8	9761	1952.2	3904.4	9820	1964	3928	9879	1975.8	3951.6
9644	1928.8	3857.6	9703	1940.6	3881.2	9762	1952.4	3904.8	9821	1964.2	3928.4	9880	1976	3952
9645	1929	3858	9704	1940.8	3881.6	9763	1952.6	3905.2	9822	1964.4	3928.8	9881	1976.2	3952.4
9646	1929.2	3858.4	9705	1941	3882	9764	1952.8	3905.6	9823	1964.6	3929.2	9882	1976.4	3952.8
9647	1929.4	3858.8	9706	1941.2	3882.4	9765	1953	3906	9824	1964.8	3929.6	9883	1976.6	3953.2
9648	1929.6	3859.2	9707	1941.4	3882.8	9766	1953.2	3906.4	9825	1965	3930	9884	1976.8	3953.6
9649	1929.8	3859.6	9708	1941.6	3883.2	9767	1953.4	3906.8	9826	1965.2	3930.4	9885	1977	3954
9650	1930	3860	9709	1941.8	3883.6	9768	1953.6	3907.2	9827	1965.4	3930.8	9886	1977.2	3954.4
9651	1930.2	3860.4	9710	1942	3884	9769	1953.8	3907.6	9828	1965.6	3931.2	9887	1977.4	3954.8
9652	1930.4	3860.8	9711	1942.2	3884.4	9770	1954	3908	9829	1965.8	3931.6	9888	1977.6	3955.2
9653	1930.6	3861.2	9712	1942.4	3884.8	9771	1954.2	3908.4	9830	1966	3932			
9654	1930.8	3861.6	9713	1942.6	3885.2	9772	1954.4	3908.8	9831	1966.2	3932.4			
9655	1931	3862	9714	1942.8	3885.6	9773	1954.6	3909.2	9832	1966.4	3932.8			
9656	1931.2	3862.4	9715	1943	3886	9774	1954.8	3909.6	9833	1966.6	3933.2			
9657	1931.4	3862.8	9716	1943.2	3886.4	9775	1955	3910	9834	1966.8	3933.6			
9658	1931.6	3863.2	9717	1943.4	3886.8	9776	1955.2	3910.4	9835	1967	3934			
9659	1931.8	3863.6	9718	1943.6	3887.2	9777	1955.4	3910.8	9836	1967.2	3934.4			
9660	1932	3864	9719	1943.8	3887.6	9778	1955.6	3911.2	9837	1967.4	3934.8			
9661	1932.2	3864.4	9720	1944	3888	9779	1955.8	3911.6	9838	1967.6	3935.2			
9662	1932.4	3864.8	9721	1944.2	3888.4	9780	1956	3912	9839	1967.8	3935.6			
9663	1932.6	3865.2	9722	1944.4	3888.8	9781	1956.2	3912.4	9840	1968	3936			
9664	1932.8	3865.6	9723	1944.6	3889.2	9782	1956.4	3912.8	9841	1968.2	3936.4			
9665	1933	3866	9724	1944.8	3889.6	9783	1956.6	3913.2	9842	1968.4	3936.8			
9666	1933.2	3866.4	9725	1945	3890	9784	1956.8	3913.6	9843	1968.6	3937.2			
9667	1933.4	3866.8	9726	1945.2	3890.4	9785	1957	3914	9844	1968.8	3937.6			
9668	1933.6	3867.2	9727	1945.4	3890.8	9786	1957.2	3914.4	9845	1969	3938			
9669	1933.8	3867.6	9728	1945.6	3891.2	9787	1957.4	3914.8	9846	1969.2	3938.4			
9670	1934	3868	9729	1945.8	3891.6	9788	1957.6	3915.2	9847	1969.4	3938.8			

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Glossary

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A/D-converter	Analog-to-digital converter
ACI	Accessory Control Interface
ADC	Analog-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic ,type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2,UEME and Zocus
CCP	Compact Camera Port
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSR	cambridge silicon radio
CSTN	Color Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analouge converter
DAC	Digital-to-analouge converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo
DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package

DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evaluation
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compability
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Associasion
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode

LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architechture
OMAP	Operations, maintenance, and administartion part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort TM	Reduced function PopPortTM interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multi Media Card
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver

SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noice ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WD	Watchdog
XHTML	Extensible hypertext markup language
Zocus	Current sensor, (used to monitor the current flow to and from the battery)